

CLAIMS

1. A system for individually labeling a recording medium as well as individually recording digital information thereon, the system comprising:
- 5 a write data source;
- an image data source; and
- a laser device interfacing with the write data source and the image data source, the laser device comprising one or more laser emitters, the one or more laser emitters used to: a) record image data on the recording medium by inducing visible color
- 10 change in laser sensitive materials on the medium surface; and b) record write data on the recording medium.
2. The system of claim 1, wherein the laser device comprises a laser emitter that both: a) records image data on the recording medium by inducing visible color change
- 15 in laser sensitive materials on the medium surface; and b) records write data on the recording medium.
3. The system of claim 1, wherein the laser device comprises a) a first laser emitter and b) a second laser emitter, the first laser emitter recording image data on
- 20 the recording medium by inducing visible color change in laser sensitive materials on the medium surface; and the second laser emitter recording write data on the recording medium.
4. The system of claim 1 wherein the laser device comprises an infrared laser.
- 25
5. The system of claim 1 wherein the laser sensitive material is selected from at least one of the group consisting of infrared sensitive dyes and heat sensitive dyes.
6. The system of claim 5, wherein the laser sensitive material comprises at least
- 30 two different dyes, each dye activatable at a different temperature.

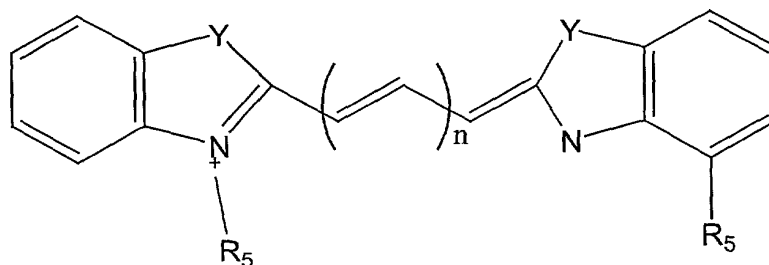
7. The system of claim 5, wherein the laser sensitive material comprises at least one dye that is activatable at a first temperature and deactivatable at a second temperature.
- 5 8. The system of claim 5 wherein the infrared sensitive dyes comprise 3'phenyl-7-diethylamino-2,2'-spirodi-(2H-1-benzopyran); IR 10000 FBK; IR 10000 FBE; IR 10000 GBK; and IR 10000 GBE.
9. The system of claim 5 wherein the infrared sensitive dyes comprise colorless
10 electron donating type dry precursor compounds which react with a developer compound to generate a dye.
10. The system of claim 9 wherein the colorless electron donating type dry
15 precursor compound has at least one of a lactone, a lactam, a sulfone, a spiropyran, an ester or an amido structure.
11. The system of claim 9 wherein the colorless electron donating type dry
precursor compound is selected from the group consisting of triarylmethane
compounds, bisphenylmethane compounds, xanthene compounds, xanthene
20 compounds, thiazine compounds, spiropyran compounds and the like.
12. The system of claim 11 wherein the colorless electron donating type dry
precursor compound is selected from the group consisting of Crystal Violet lactone,
benzoyl leuco methylene blue, Malachite Green Lactone, p-nitrobenzoyl leuco
25 methylene blue, 3-dialkylamino-7-dialkylamino-fluoran, 3-methyl-2,2'-spirobi(benzof-chrome), 3,3-bis(p-dimethylaminophenyl)phthalide, 3-(p-dimethylaminophenyl)-3-(2-methylindole-3-yl)phthalide, 3-(p-dimethylaminophenyl)-3-(2-phenylindole-3-yl)phthalide, 3,3-bis(1,2-dimethylindole-3-yl-5-dimethylaminophthalide, 3,3-bis-(1,2-dimethylindole-3-yl)6-dimethylaminophthalide, 3,3-bis-(9-ethylcarbazole-3-yl)-5-
30 dimethylaminophthalide, 3,3-bis(2-phenylindole-3-yl)-5-dimethylaminophthalide, 3-p-dimethylaminophenyl-3-(1-methyl pyrrole-2-yl)-6-dimethylaminophthalide, 4,4'-

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- bis-dimethylaminobenzhydrin benzyl ether, N-halophenyl leuco Auramine, N-2,4,5-trichlorophenyl leuco Auramine, Rhodamine-B-anilinolactam, Rhodamine-(p-nitroanilino)lactam, Rhodamine-B-(p-chloroanilino)lactam, 3-dimethylamino-7-methoxyfluoran, 3-diethylamino-7-methoxyfluoran, 3-diethylamino-7-(acetylmethylamino)fluoran, 3-diethylamino-7-(dibenzylamino)fluoran, 3-diethylamino-7-(methylbenzylamino)fluoran, 3-diethylamino-7-(chloroethylmethylamino)fluoran, 3-diethylamino-7-(diethylamino)fluoran, 3-methyl-spiro-dinaphthopyran, 3,3'-dichloro-spiro-dinaphthopyran, 3-benzyl-spiro-dinaphthopyran, 3-methyl-naphtho-(3-methoxybenzo)-spiropyran, 3-propyl-spirodibenzoidipyran, and combinations thereof.

13. The system of claim 5 wherein the infrared sensitive dyes cyanine dyes represented by the following formula (XX);

(XX)



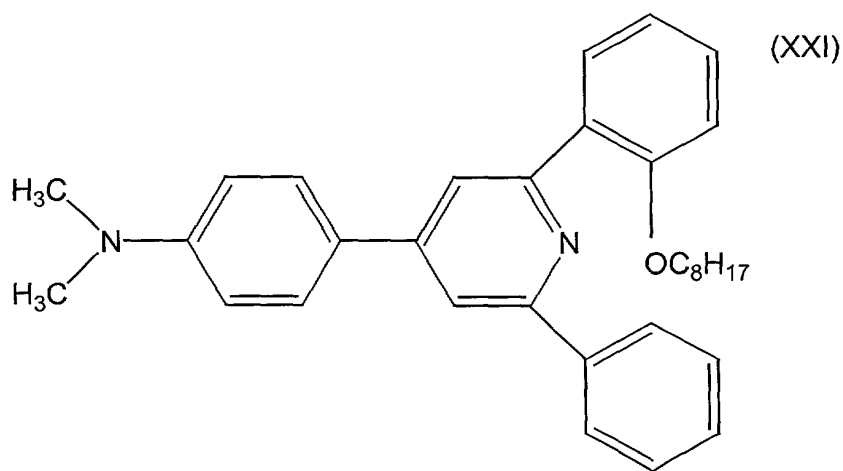
wherein n is 0, 1, 2 or 3; R5 represents an alkyl group; and Y represents CH=CH, N-CH3, C(CH3)2, O, S or Se.

14. The system of claim 5 wherein the infrared sensitive dyes comprise a compound having at least one of a lactone, lactam, sulfone, spiropyran, ester, and amide structure.

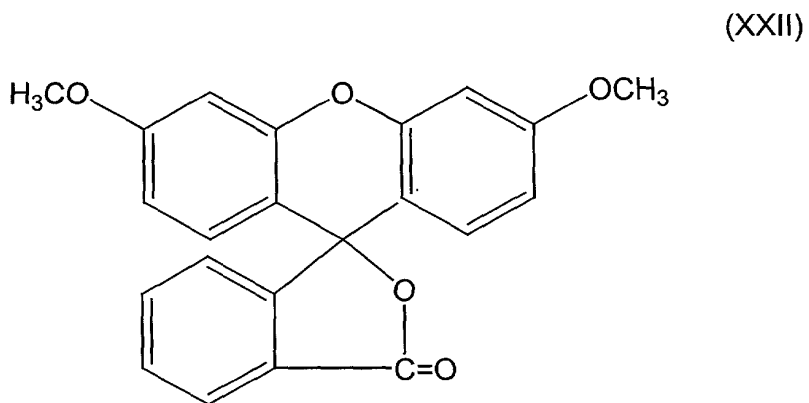
15. The system of claim 14 wherein the infrared sensitive dyes are selected from the group consisting of triarylmethane compounds, bisphenyl methane compounds, xanthene compounds, fluoran compounds, thiazine compounds and spiropyran compounds.

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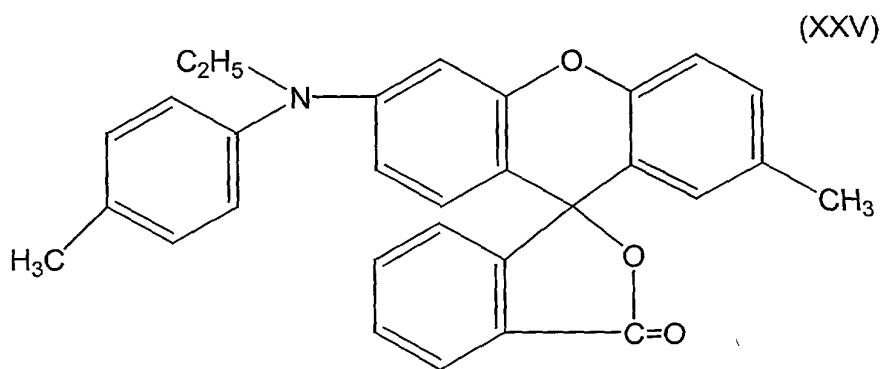
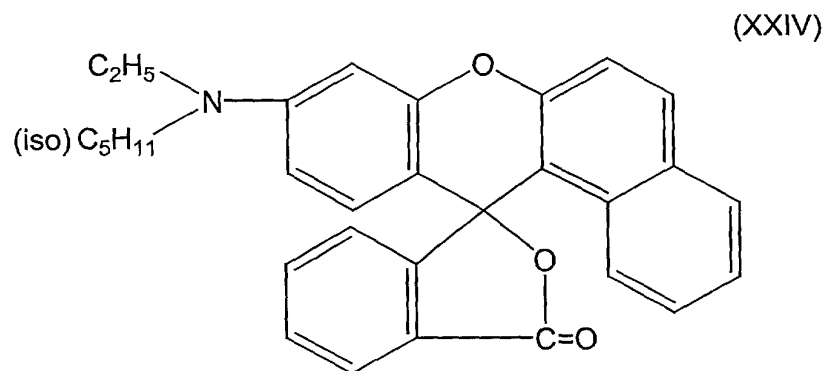
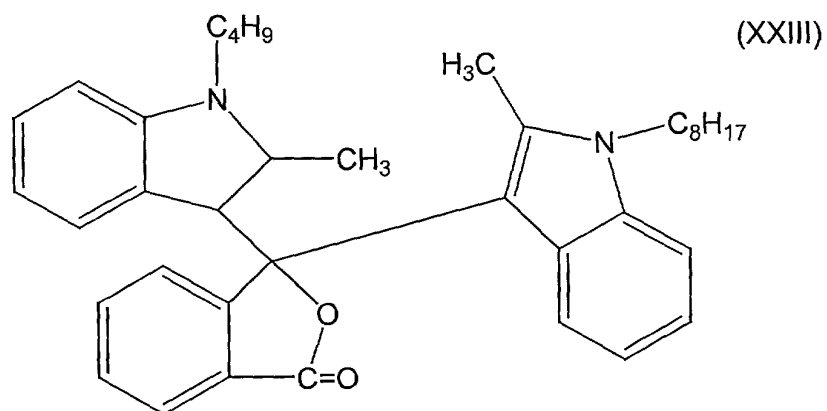
16. The system of claim 5 wherein the infrared sensitive dyes are yellow dyes selected from the group consisting of.



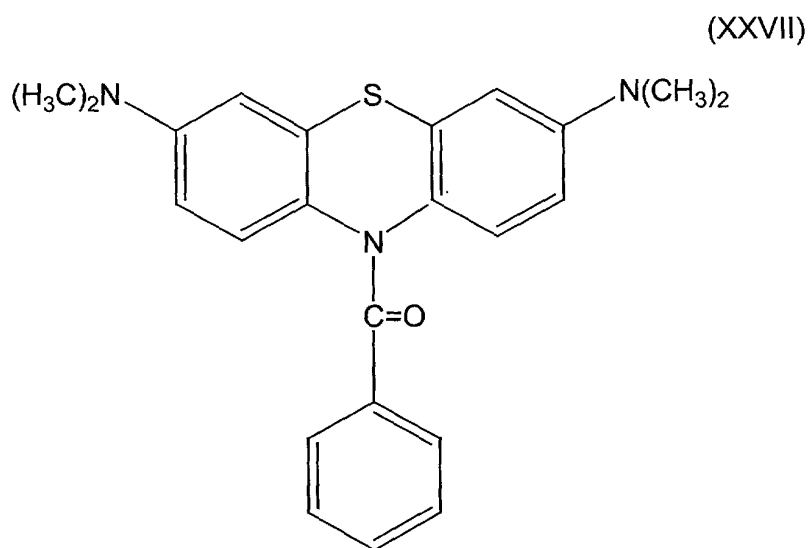
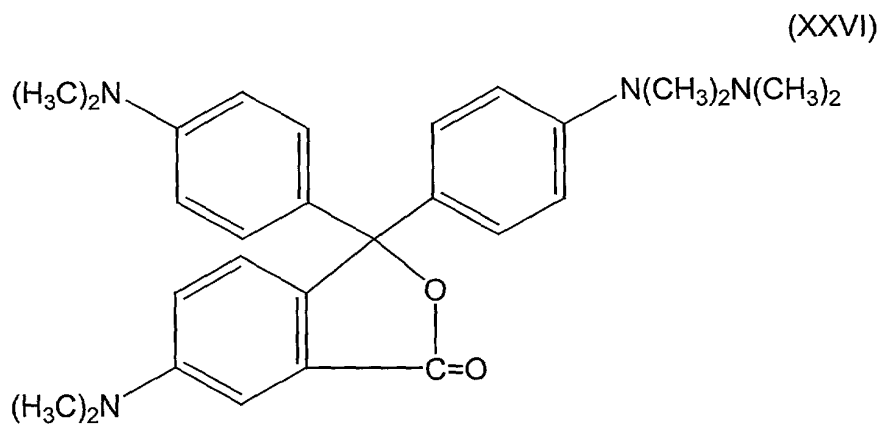
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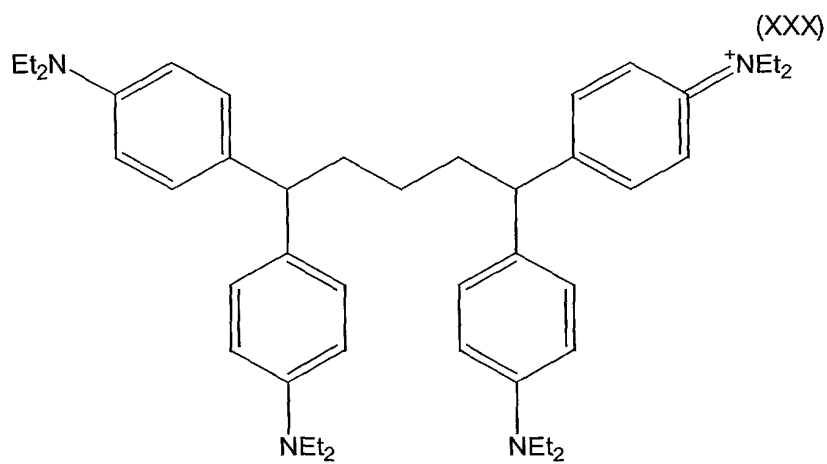
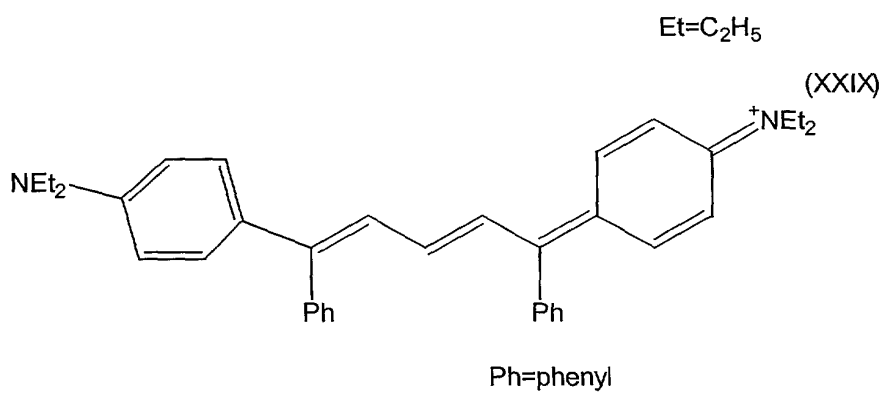
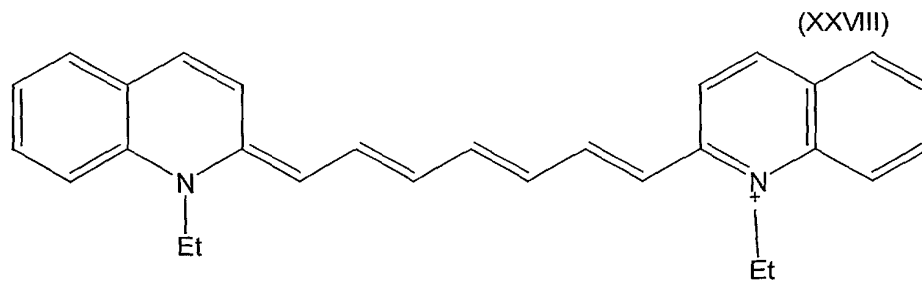
17. The system of claim 5 wherein the infrared sensitive dyes are Magenta dyes selected from the group consisting of



18. The system of claim 5 wherein the infrared sensitive dyes are cyan dyes selected from the group consisting of



19. The system of claim 5 wherein the infrared sensitive dyes are selected from the group consisting of



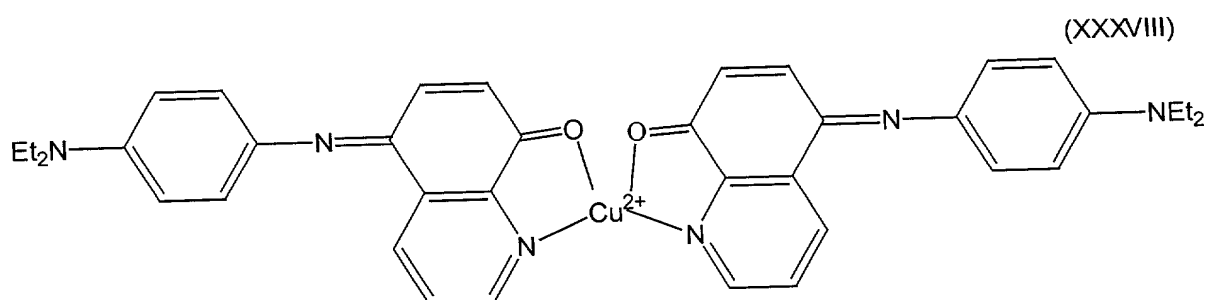
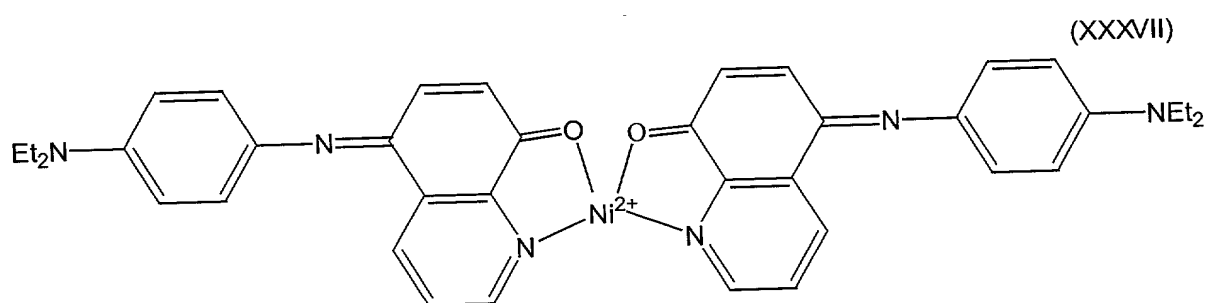
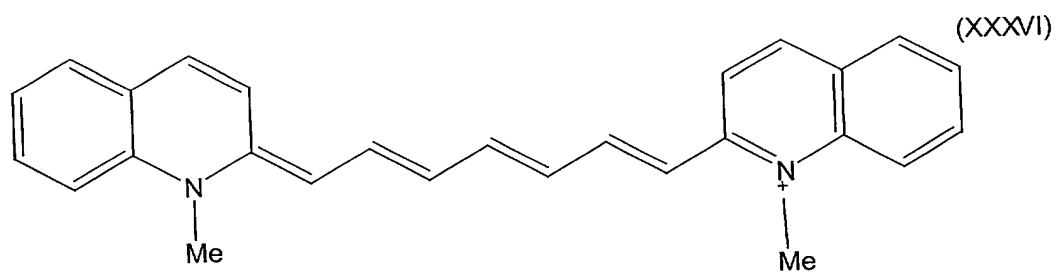
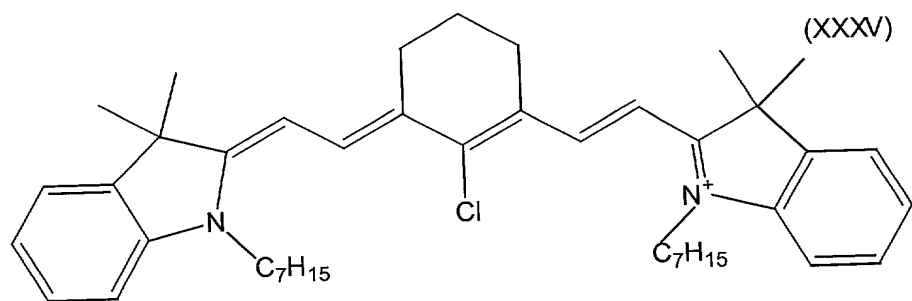
CCN1C(=C/C=C/C=C/C=C/C=C/C=C/C=C/C=S1c2ccccc2)[N+]3C(=C/C=C/C=C/C=C/C=C/C=C/C=C/C=S3c4ccccc4)CC (XXXI)

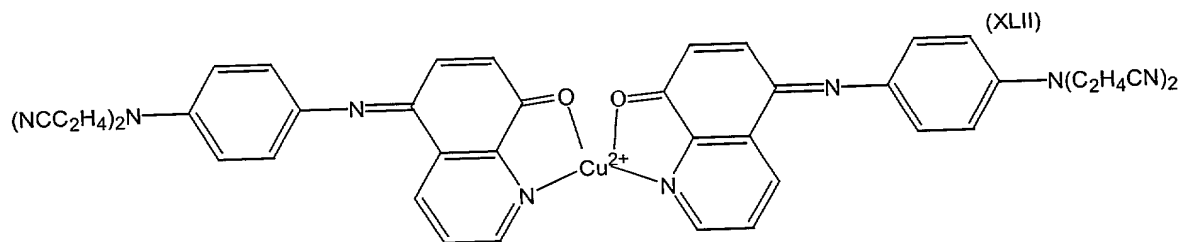
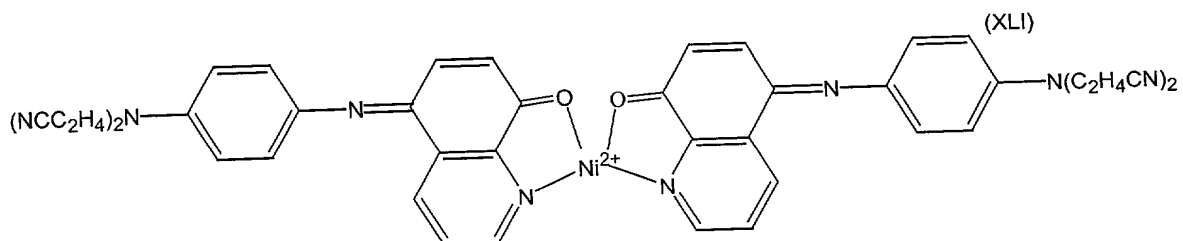
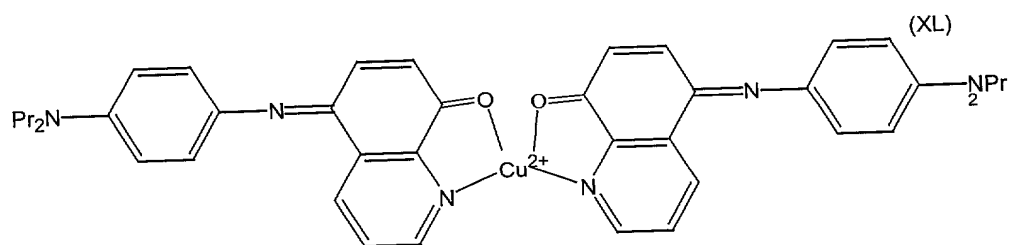
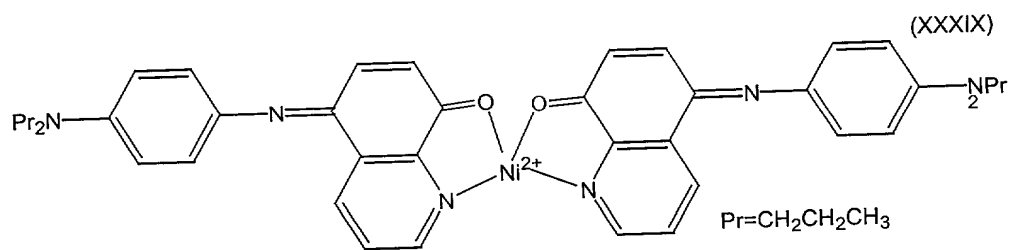
(XXXII)
Me=CH₃

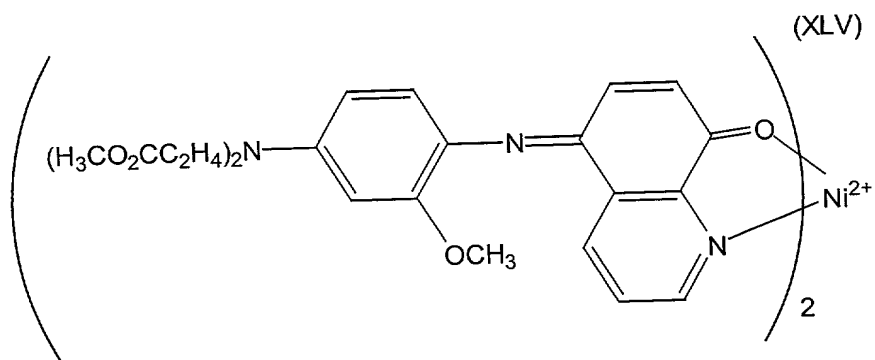
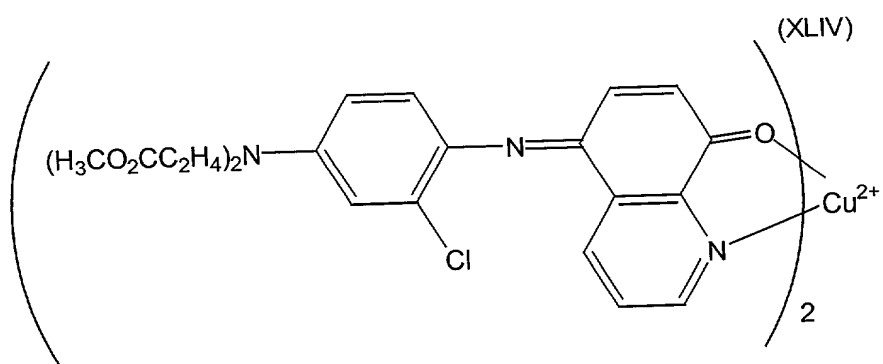
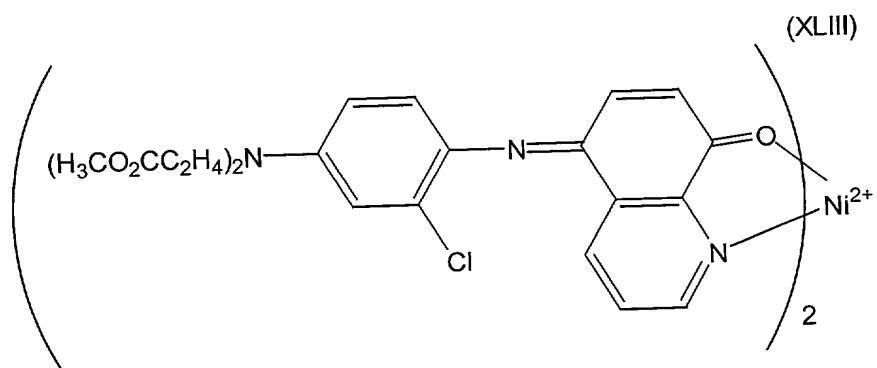
CN1C=C(C2C=CC=CC=C2C3=CC=CC=C13)C=CC=CC=CC=C[N+]1(C)C=C(C2C=CC=CC=C2C3=CC=CC=C13)C (XXXIII)

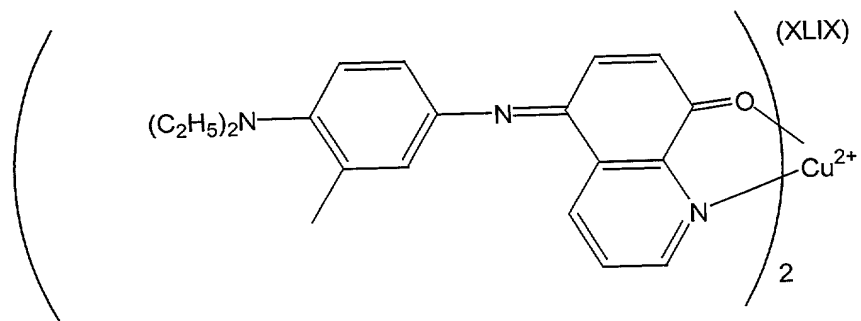
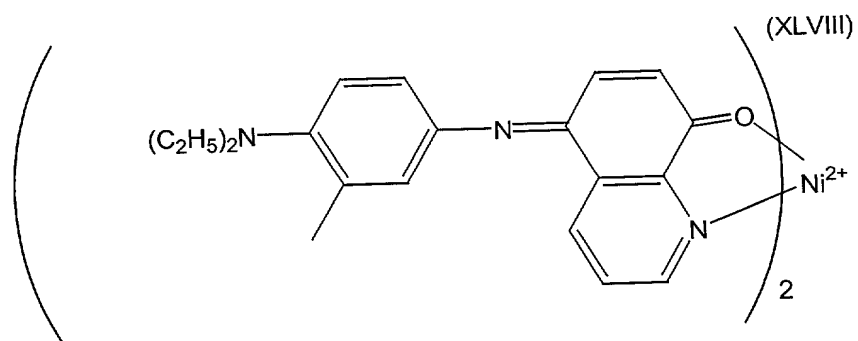
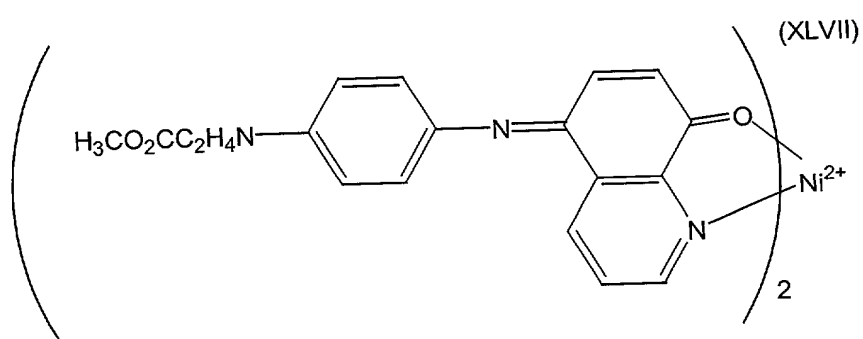
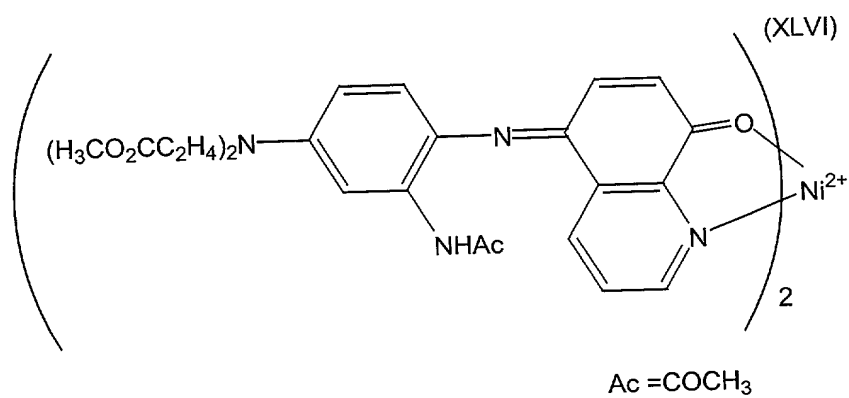
(XXXIV)

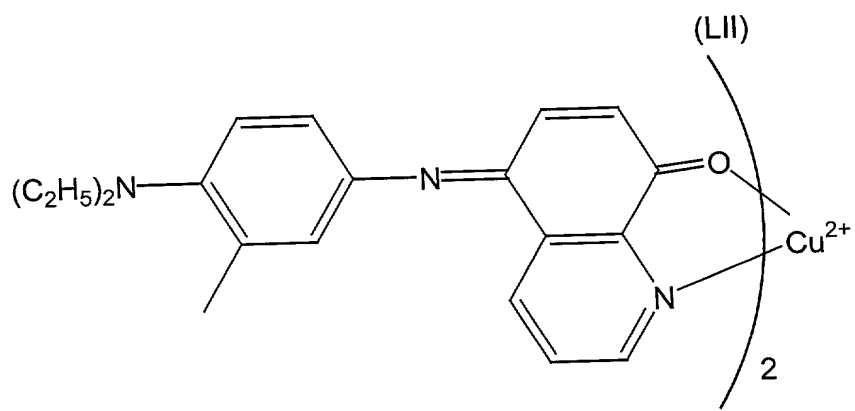
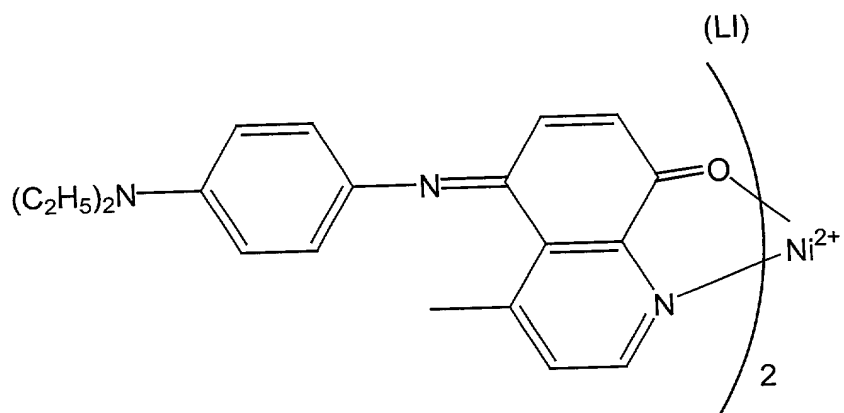
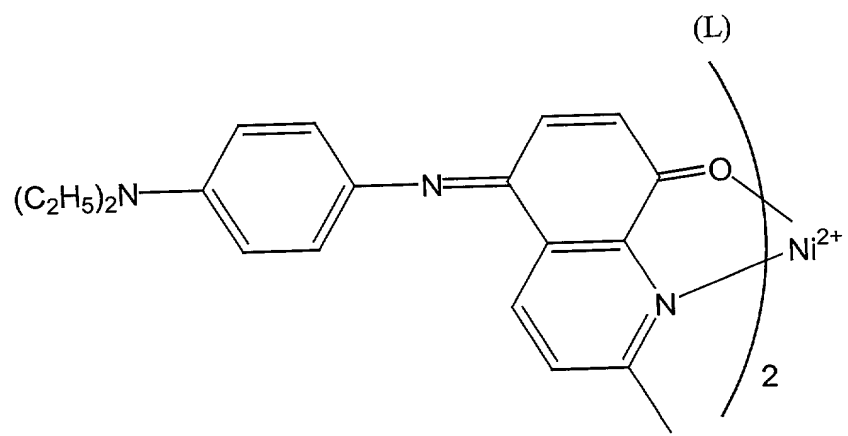
CN1C=CC2=CC=CC=C2C1=C/C=C/C3=CC(=C/C=C/C4=CC(=C)C(C)(C)N4C)C=C3Cl











20. The system of claim 5 wherein the heat sensitive dyes comprises Basic Green 4; Solvent Yellow 56; Chemithermal CFBK90; Chemithermal CFBK120; Chemithermal CFBE90; Chemithermal CFBE120; Permanent Temp Tell Yellow Ink; Permanent Temp Tell Red Ink; Permanent Temp Tell Blue Ink; Permanent Temp Tell Green Ink; Permanent Temp Tell Orange Ink; Permanent Temp Tell Purple Ink; and Permanent Temp Tell Black Ink.

21. The system of claim 5 wherein the heat sensitive dyes are leuco dyes selected from the group consisting of:

10 aminotriarylmethanes; aminoxanthenes; aminothioxanthenes; amino-9,10-dihydroacridines; aminophenoxazines; aminophenothiazines; aminodihydrophenazines; aminodiphenylmethanes; leuco indamines; aminohydrocinnamic acids (cyanoethanes, leuco methines) and corresponding esters; hydrozines; leuco indigoid dyes; amino-2,3-dihydroanthraquinones; tetrahalo-p,p'-

15 biphenols; 2(p-hydroxyphenyl)-4,5-diphenylimidazoles; phenethylanilines; indanones and combinations thereof.

22. The system of claim 19 wherein the leuco dyes are selected from the group consisting of aminotriarylmethanes, aminoxanthenes, and leucoindigoid dyes.

20

23. The system according to claim 22, the leuco dyes being aminotriarylmethanes wherein two of the aryl groups are phenyl groups having an R1R2N-substituent in the position para to the bond to the methane carbon atom and wherein each of R1 and R2 are independently selected from hydrogen, C1-C10 alkyl, 2-hydroxyethyl, 2-

25 cyanoethyl, and benzyl and wherein the third aryl group is selected from:

a) phenyl which can be substituted with lower alkyl, lower alkoxy, chloro, diphenylamino, cyano, nitro, hydroxy, fluoro or bromo;

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- b) naphthyl which can be substituted with amino, di-lower alkylamino, alkylamino;
- c) pyridyl which can be substituted with alkyl;
- d) quinolyl;
- 5 e) indolinylidene which can be substituted with alkyl.

24. The system according to claim 23, wherein R1 and R2 are selected from hydrogen and alkyl of 1-4 carbon atoms.

- 10 25. The system according to claim 22 wherein the aminotriarylmethanes are selected from tris(N,N-dimethylaminophenyl)methane (LCV); deuterio-tris(N,N-dimethylaminophenyl)methane (D-LCV); tris(N,N-diethylaminophenyl)methane (LECV); deuterio-tris(4-diethylaminophenyl)methane (D-LECV); tris(N,N-di-n-propylaminophenyl)methane (LPCV); tris(N,N-di-n-butylaminophenyl)methane (LBCV); bis(4-diethylaminophenyl)-(4-diethylamino-2-methyl-phenyl)methane (LV-1); bis(4-diethylamino-2-methylphenyl)-(4-diethylamino-phenyl)methane (LV-2); tris(4-diethylamino-2-methylphenyl)methane (LV-3); deuterio-bis(4-diethylaminophenyl)-(4-diethylamino-2-methylphenyl)methane (D-LV-1); deuterio-bis(4-diethylamino-2-methylphenyl)(4-
- 15 diethylaminophenyl)methane (D-LV-2); bis(4-diethylamino-2-methylphenyl)(3,4-dimethoxyphenyl)methane (LB-8);
- 20

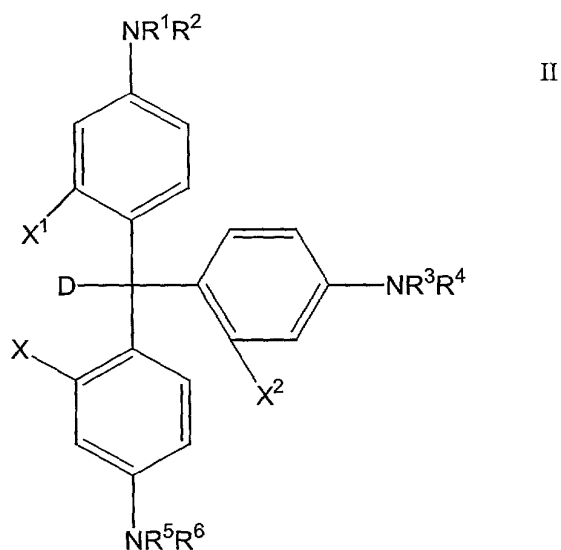
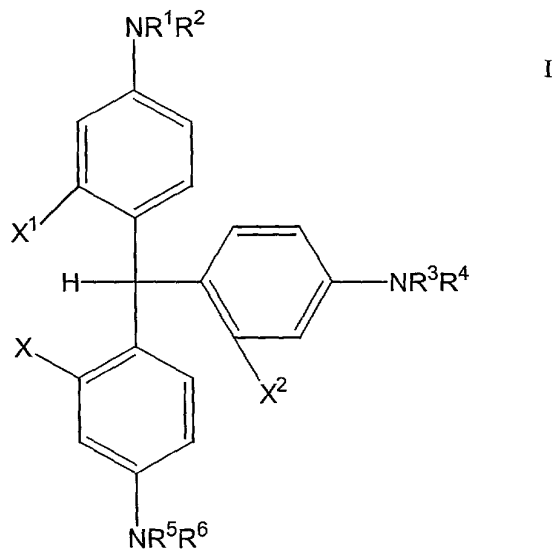
26. The system of claim 25 wherein the aminotriarylmethane leuco dyes have alkyl substituents selected from C1-C4 alkyl, the substituents bonded to the amino
- 25 moieties.

27. The system of claim 26 wherein the aminotriaryl methane leuco dyes are further substituted with one or more alkyl groups on the aryl rings, the alkyl groups being independently selected from C1-C3 alkyl.

28. The system of claim 25 wherein the amino triarylmethane leuco dyes are selected from the group consisting of: D-LECV, LV-1, LV-2, D-LV-1, and D-LV-2.
29. The system of claim 28 wherein at least one of the aminotriarylmethane leuco
5 dyes is selected from LV-1 and LV-2.
30. The system of claim 28 wherein at least one of the aminotriarylmethane leuco dyes is Trans-3-hydroxy-2-(p-diethylaminobenzyl)indanone (LY-1).
- 10 31. The system of claim 28 wherein at least one of the aminotriarylmethane leuco dyes is Benzo((a)-6-N,N-diethylamino-9-(2-methoxycarbonyl)-phenylxanthene (LM-5).

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32. The system of claim 28 wherein the aminotriarylmethane leuco dyes comprise at least one of chemical structures I and II:



wherein I and II have components X, X¹, X² and R₁ through R₆ selected from a) through g):

- 5 a) X, X¹ and X² are H; R¹ through R⁶ are H.
 b) X, X¹ and X² are H; R¹ through R⁶ are CH₃.
 c) X, X¹ and X² are H; R¹ through R⁶ are C₂H₅.
 d) X, X¹ and X² are H; R¹ through R⁶ are independently selected from H and C3-8 alkyl.

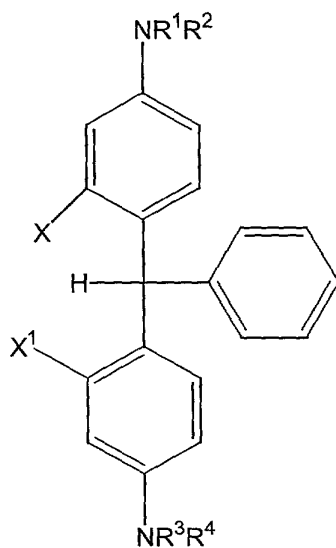
e) X and X¹ are H; X² is CH₃; R¹ through R⁶ are independently selected from H and C1-C8 alkyl.

f) X is H; X¹ and X² are CH₃; R¹ through R⁶ are independently selected from H and C1-C8 alkyl.

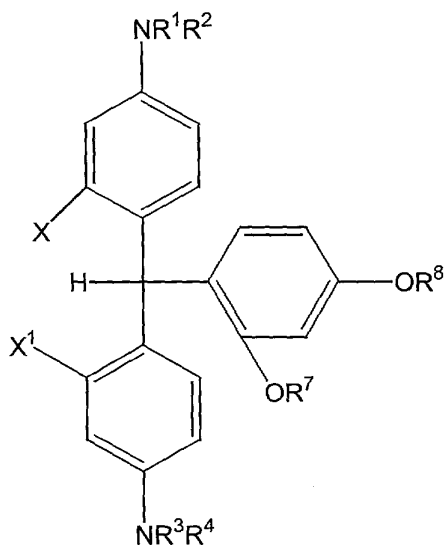
5 g) X, X¹ and X² are H; R¹, R³ and R⁵ are independently selected from aryl C6-C10; substituted C6-C10 aryl; and R², R⁴, and R⁶ are H.

33. The system of claim 26 wherein the aminotriarylmethane leuco dyes comprise at least one of chemical structures III through VI:

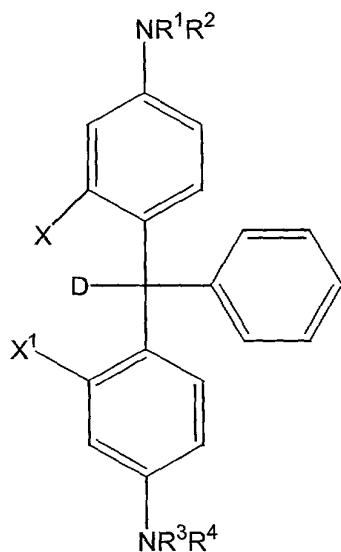
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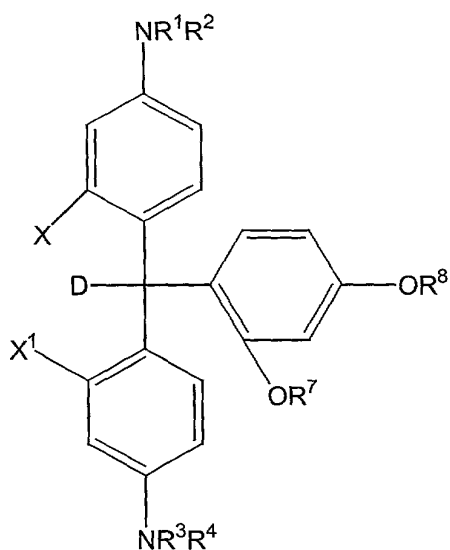
III



IV



V



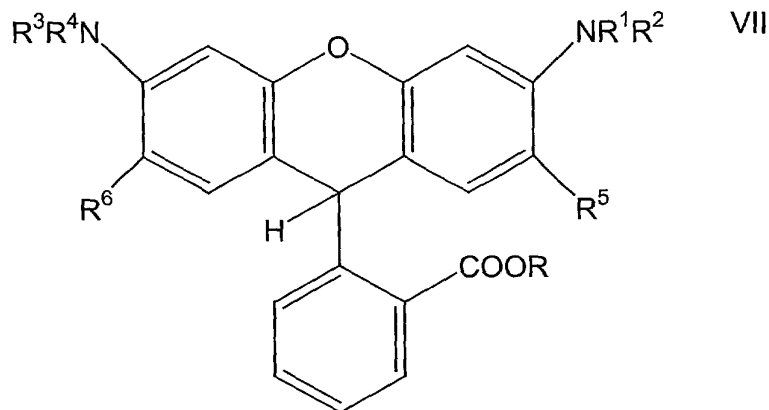
VI

wherein III through VI have components X, X¹, X² and R¹ through R⁶ selected from a) through c):

- 5 a) X and X¹ are H; and R¹ through R⁴ are independently selected from H and C1-C8 alkyl
- b) X and X¹ are H and R¹ and R³ are aryl; and R² and R⁴ are H
- c) X = CH₃, X¹ = H and R¹ through R⁴ are independently selected from H and C1-C8 alkyl; and R⁷ and R⁸ are independently selected from C1-C8 alkyl, or R⁷

and R⁸ are bridged to form a cyclic attachment with a CH₂- or C₂H₄- bond, thereby forming a five- or six-membered ring, respectively.

34. The system of claim 28 wherein the aminotriarylmethaneleuco dyes comprise
5 chemical structure VII:



- wherein R is independently selected from H, C1-C8 alkyl; R⁵ and R⁶ are
independently selected from H and C1-C4 alkyl; R¹ through R⁴ are independently
selected from H and C1-C6 alkyl, C6-C10 aryl with the proviso that, if R¹ and R³ are
10 aryl, then R² and R⁴ are hydrogen.

35. The system of claim 22 wherein the leuco dyes comprise at least one of
aminotriarylmethanes and aminoxanthenes.

- 15 36. The system of claim 7 wherein the heat sensitive dyes are near IR-absorbing
dyes comprising at least one of

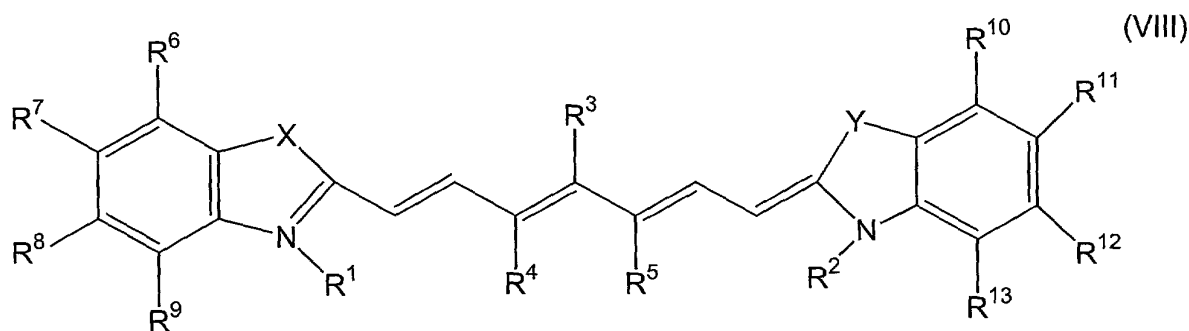
- 1) DF-1: 2-((2-((2-chloro-3-(((1,3-dihydro-1,3,3-trimethyl-2H-indol-2-
ylidene)ethylidene)-1-cyclopenten-1-yl)ethenyl)-1,3,3-trimethyl-3H-indolium
trifluoromethanesulfonate;
20 2) RD-1: Cyasorb® IR-165 Near IR Dye(absorption maximum at 1070 nm); and

3) SQS 4((((3-((((2,6-bis(1,10-dimethylethyl)-4H-thiopyrann-4-ylidene)methyl)-2-methyl)2-hydroxy-4-oxo-2-cyclobuten-1-ylidene)methyl-2,6-bis(1,1-dimethylethyl)thiopyrilium hydroxide, inner salt,

37. The system of claim 36 wherein the heat sensitive dyes are near IR absorbing dyes comprising at least one of DF-1 and RD-1.

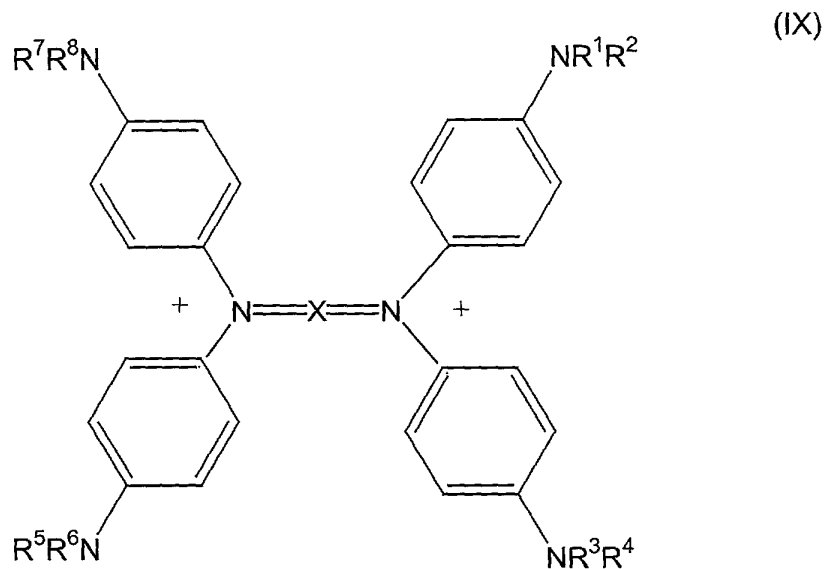
38. The system of claim 37 wherein the heat sensitive dyes are near IR absorbing dyes comprising DF-1.

39. The system of claim 5 wherein the heat sensitive dyes comprise Heptamethine cyanine dyes having a chemical structure (VIII) as shown below:



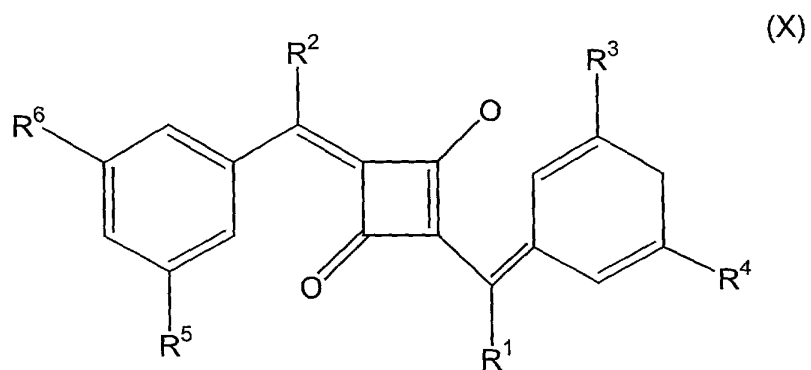
where R3 can be H, halogen, alkyl, aryl, alkoxy, aryloxy, thioalkyl, or thioaryl; R4 and R5 are independently selected from H, alkyl, aryl, or are bridged to form a cyclic attachment; each of R6 through R13 is independently selected from H, alkyl, aryl, or any two adjacent R6 through R9 and any two adjacent R10 through R13 can form a fused aryl; each of R1 and R2 are independently selected from alkyl, aryl and substituted alkyl; X and Y, which may or may not be identical, are each represented by the formula CR'R'' where R', R'' are independently selected from alkyl, aryl and substituted alkyl; X and Y, which may or may not be identical, are each represented by the formula CR'R'' where R', R'' are independently selected from H, C1-C6 alkyl, O, S, Se and Te.

40. The system of claim 5 wherein the heat sensitive dyes comprise Benzenaminium dyes having structure (IX) as shown below:

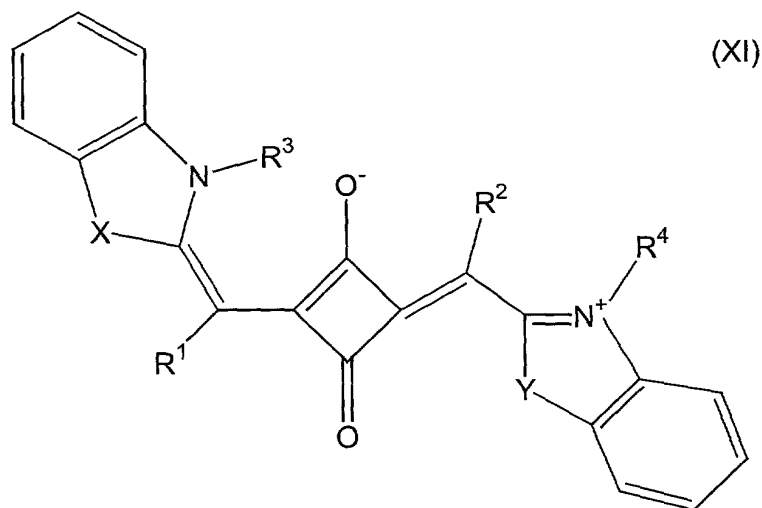


5 wherein each of R^1 through R^8 is independently selected from C1-C6 alkyl; X is a substituted 1,4-cyclohexadiene.

41. The system of claim 5 wherein the heat sensitive dyes are near IR-absorbing dyes having structure (X) or structure (XI) as shown below:



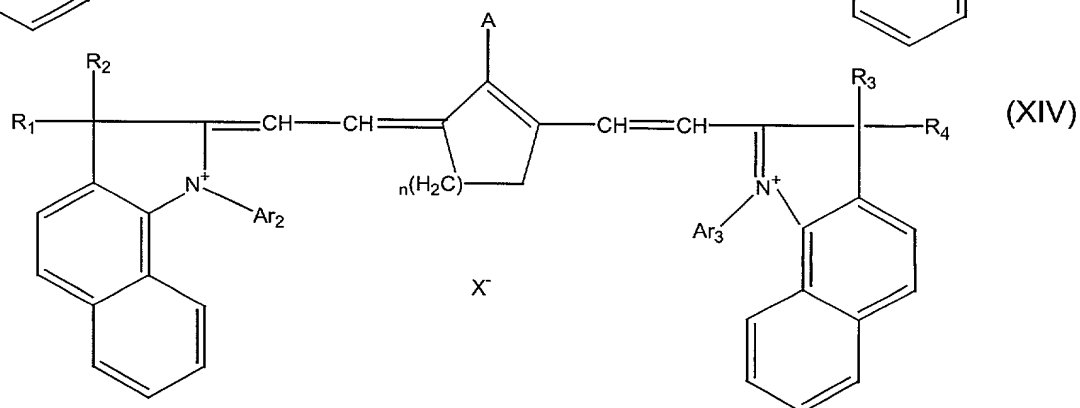
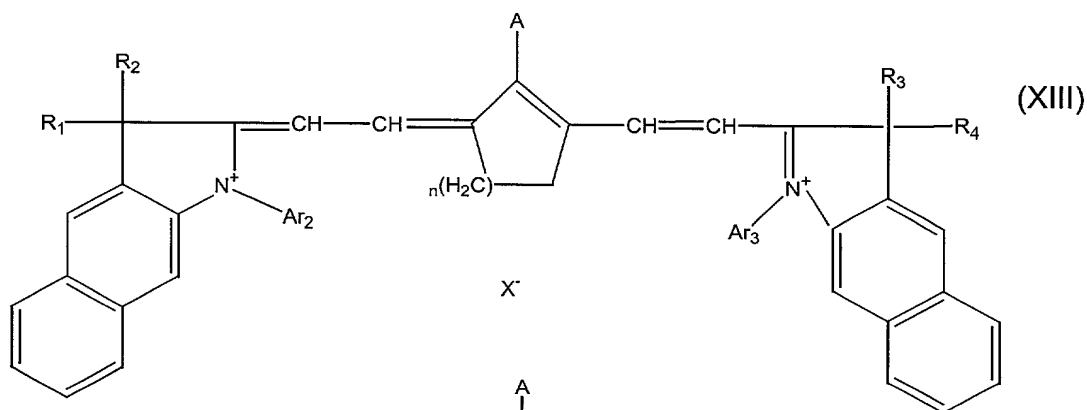
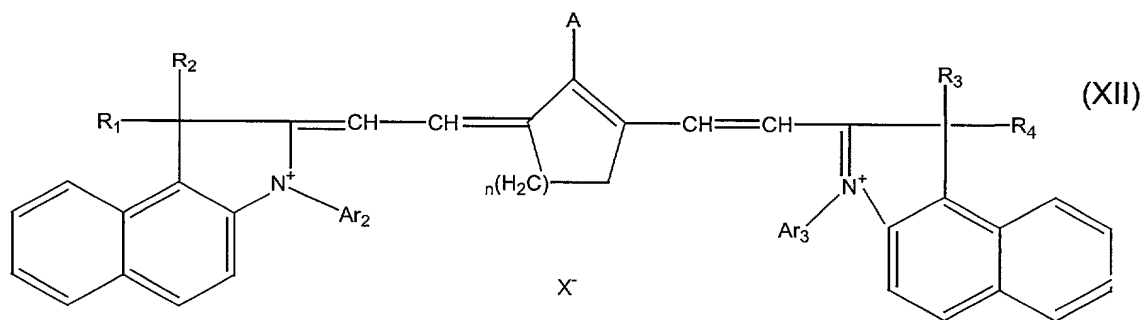
wherein each of R1 through R6 is independently selected from H, C1-C6 alkyl; X and Y are independently selected from O, S, Se, Te, N-R7, wherein R7 is selected from C1-C6 alkyl and



- 5 wherein each of R1 and R2 is independently selected from H, C1-C6 alkyl; each of X and Y is independently selected from O, S, Se, Te, N—R7, wherein R7 is selected from C1-C6 alkyl; each R3 and R4 is independently selected from alkyl, aryl or substituted alkyl and wherein the benzene rings in structure (XI) may be further substituted.

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42. The system of claim 5 wherein the heat sensitive dyes are near IR-absorbing dyes selected from the group consisting of:



wherein R1-R4 are independently substituted or unsubstituted C1-C6 alkyl; A is substituted or unsubstituted phenyl, naphthyl, C1-C6 alkyl, or C7-C10 aralkyl; Ar2 and Ar3 are independently substituted or unsubstituted phenyl or naphthyl; X is a monovalent anion; and n is 1 or 2.

43. The system of claim 42 wherein the alkyl, aryl or aralkyl substitution groups comprise at least one of: hydroxy, alkoxy, chloro, bromo, cyano, and amino.

44. The system of claim 5 wherein the heat-sensitive dyes are near IR-absorbing dyes selected from the group consisting of: 2-((2((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((e)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclohexen-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((e)indolium p-toluenesulfonate (JC-1); 2-((2((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((e)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclopenten-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((e)indolium p-toluenesulfonate (JC-2); 2-((2((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((f)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclohexen-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((f)indolium p-toluenesulfonate (JC-3); 2-((2((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((f)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclopenten-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((f)indolium p-toluenesulfonate (JC-4); 2-((2((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((g)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclohexen-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((g)indolium p-toluenesulfonate (JC-5); 2-((2((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((g)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclopenten-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((g)indolium p-toluenesulfonate (JC-6).
45. The system of claim 44 wherein the near IR-absorbing dyes comprise at least one of JC-1 and JC-2.
46. The system of claim 44 wherein the near IR-absorbing dyes comprise JC-1.
47. The system of claim 5 wherein the light sensitive and temperature sensitive dyes are encapsulated in microcapsules, the microcapsules comprising polymers having T_g from 80°C to 200°C.
48. The system of claim 47 wherein the polymers are selected from the group consisting of polyurethanes, acrylates, styrenes and combinations thereof.

49. The system of claim 47 wherein the polymers comprise styrene-butylacrylate-polyethylene glycol acrylate.

50. A method for recording in a digital recorder both write data and image data on
5 a recording medium, the method comprising:

placing the recording medium in a digital recorder;

transferring write data from a write data source to the digital recorder;

recording the transferred write data onto the medium with a digital recording
device;

10 transferring image data from an image data source to the digital recorder; and
recording the transferred image data onto the medium by inducing visible
color change in laser sensitive materials on the medium with a laser device while the
medium is within the recorder

15 51. The method of claim 50, wherein the laser device comprises a laser emitter
that both: a) records image data on the recording medium by inducing visible color
change in laser sensitive materials on the medium surface; and b) records write data
on the recording medium.

20 52. The method of claim 50, wherein the laser device comprises a) a first laser
emitter and b) a second laser emitter, the first laser emitter recording image data on
the recording medium by inducing visible color change in laser sensitive materials on
the medium surface; and the second laser emitter recording write data on the recording
medium.

25

53. The method of claim 50 wherein the laser beams comprises an infrared laser.

54. The method of claim 50 wherein the laser activatable material is selected from
at least one of the group consisting of infrared sensitive dyes and heat sensitive dyes.

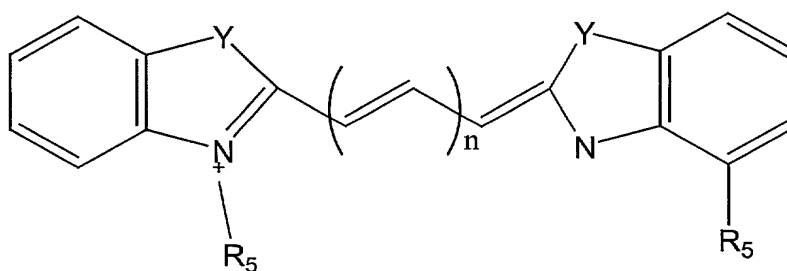
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55. The method of claim 54, wherein the laser sensitive material comprises at least two different dyes, each dye activatable at a different temperature.
56. The method of claim 54, wherein the laser sensitive material comprises at least one dye that is activatable at a first temperature and deactivatable at a second temperature.
57. The method of claim 54 wherein the infrared sensitive dyes comprise 3'phenyl-7-diethylamino-2,2'-spirodi-(2H-1-benzopyran)); IR 10000 FBK; IR 10000 FBE; IR 10000 GBK; and IR 10000 GBE.
58. The method of claim 54 wherein the infrared sensitive dyes comprise colorless electron donating type dry precursor compounds which react with a developer compound to generate a dye.
59. The method of claim 58 wherein the colorless electron donating type dry precursor compound has at least one of a lactone, a lactam, a sulfone, a spiropyran, an ester or an amido structure.
60. The method of claim 58 wherein the colorless electron donating type dry precursor compound is selected from the group consisting of triarylmethane compounds, bisphenylmethane compounds, xanthene compounds, xanthene compounds, thiazine compounds, spiropyran compounds and the like.
61. The method of claim 60 wherein the colorless electron donating type dry precursor compound is selected from the group consisting of Crystal Violet lactone, benzoyl leuco methylene blue, Malachite Green Lactone, p-nitrobenzoyl leuco methylene blue, 3-dialkylamino-7-dialkylamino-fluoran, 3-methyl-2,2'-spirobi(benzof-chrome), 3,3-bis(p-dimethylaminophenyl)phthalide, 3-(p-dimethylaminophenyl)-3-(2-methylindole-3-yl)phthalide, 3-(p-dimethylaminophenyl)-3-(2-phenylindole-3-yl)phthalide, 3,3-bis(1,2-dimethylindole-3-yl-5-dimethylaminophthalide, 3,3-bis-(1,2-

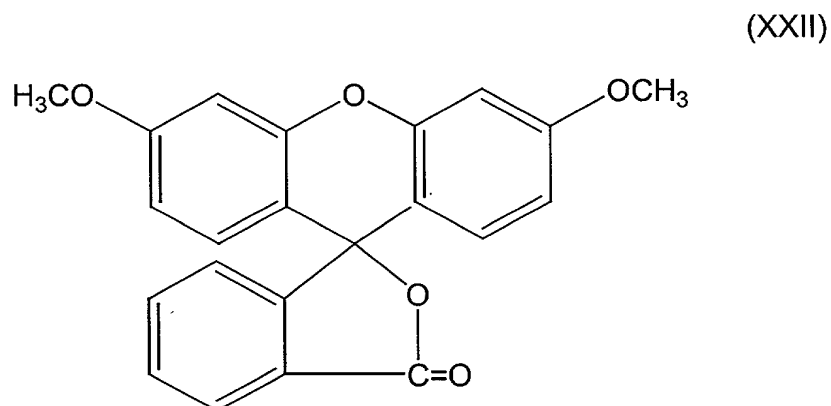
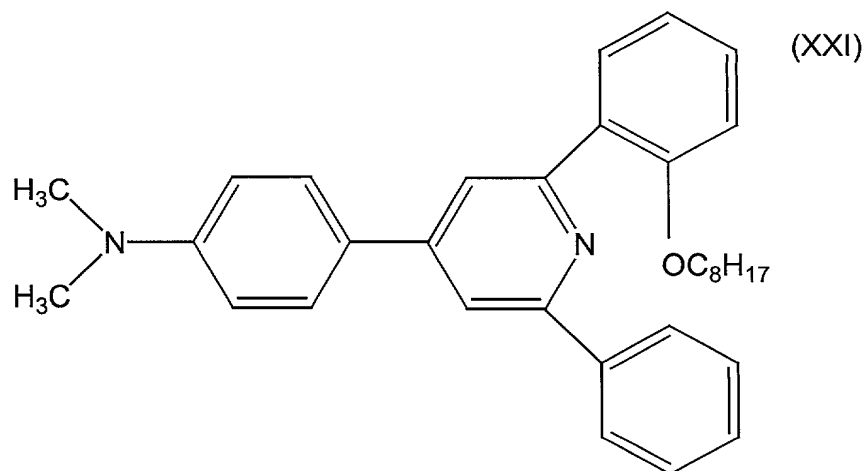
- dimethylindole-3-yl)6-dimethylaminophthalide, 3,3-bis-(9-ethylcarbazole-3-yl)-5-dimethylaminophthalide, 3,3-bis(2-phenylindole-3-yl)-5-dimethylaminophthalide, 3-p-dimethylaminophenyl-3-(1-methyl pyrrole-2-yl)-6-dimethylaminophthalide, 4,4'-bis-dimethylaminobenzhydrin benzyl ether, N-halophenyl leuco Auramine, N-2,4,5-trichlorophenyl leuco Auramine, Rhodamine-B-anilinolactam, Rhodamine-(p-nitroanilino)lactam, Rhodamine-B-(p-chloroanilino)lactam, 3-dimethylamino-y-methoxyfluoran, 3-diethylamino-7-methoxyfluoran, 3-diethylamino-7-(acetylmethylamino)fluoran, 3-diethylamino-7-(dibenzylamino)fluoran, 3-diethylamino-7-(methylbenzylamino)fluoran, 3-diethylamino-7-(chloroethylmethylamino)fluoran, 3-diethylamino-7-(diethylamino)fluoran, 3-methyl-spiro-dinaphthopyran, 3,3'-dichloro-spiro-dinaphthopyran, 3-benzyl-spiro-dinaphthopyran, 3-methyl-naphtho-(3-methoxybenzo)-spiropyran, 3-propyl-spirodibenzoidipyran, and combinations thereof.
62. The method of claim 54 wherein the infrared sensitive dyes are cyanine dyes represented by the following formula (XX);

(XX)

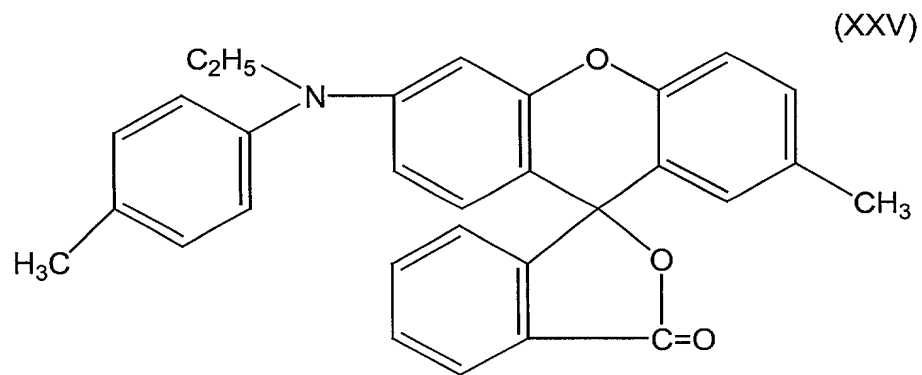
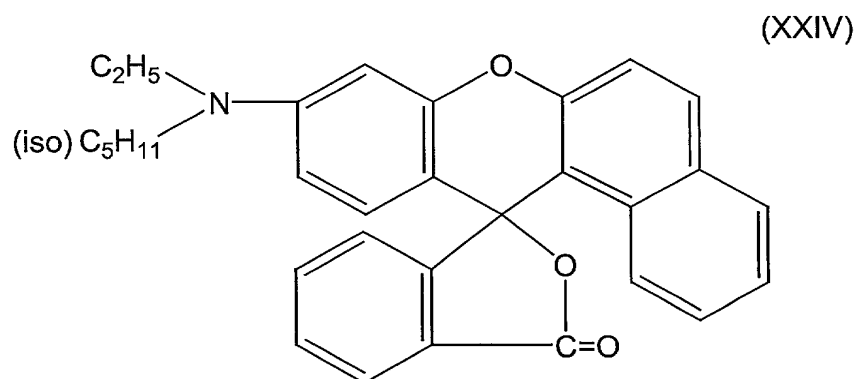
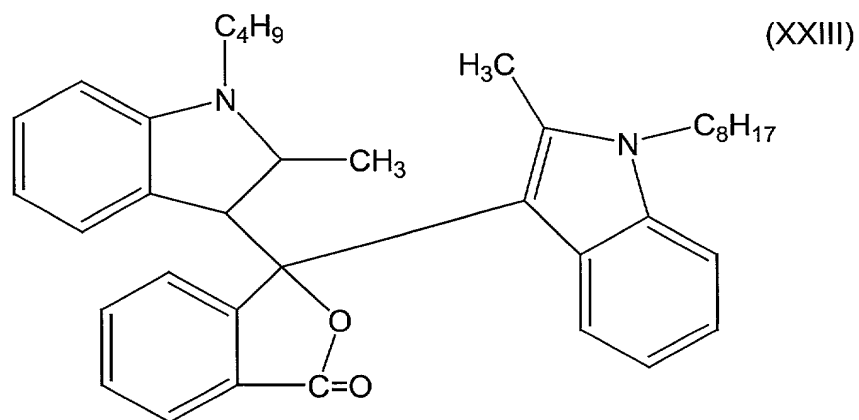


- wherein n is 0, 1, 2 or 3; R₅ represents an alkyl group; and Y represents CH=CH, N-CH₃, C(CH₃)₂, O, S or Se.

63. The method of claim 54 wherein the infrared sensitive dyes comprise a compound having at least one of a lactone, lactam, sulfone, spiropyran, ester, and amide structure.
- 5 64. The method of claim 63 wherein the infrared sensitive dyes are selected from the group consisting of triarylmethane compounds, bisphenyl methane compounds, xanthene compounds, fluoran compounds, thiazine compounds and spiropyran compounds.
- 10 65. The method of claim 54 wherein the infrared sensitive dyes are yellow dyes selected from the group consisting of.

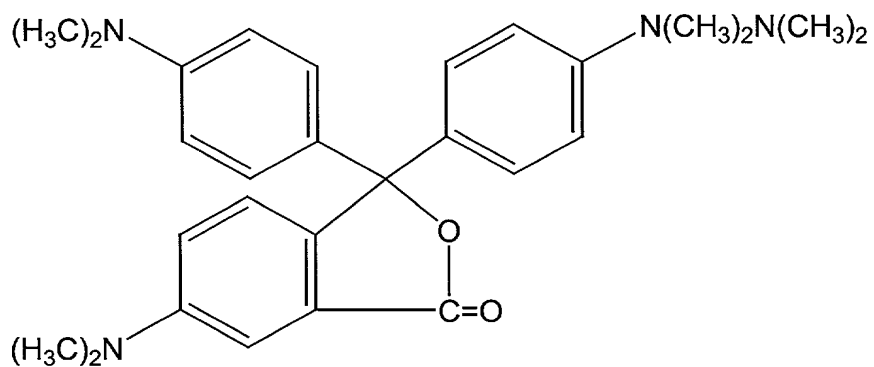


66. The method of claim 54 wherein the infrared sensitive dyes are magenta dyes selected from the group consisting of

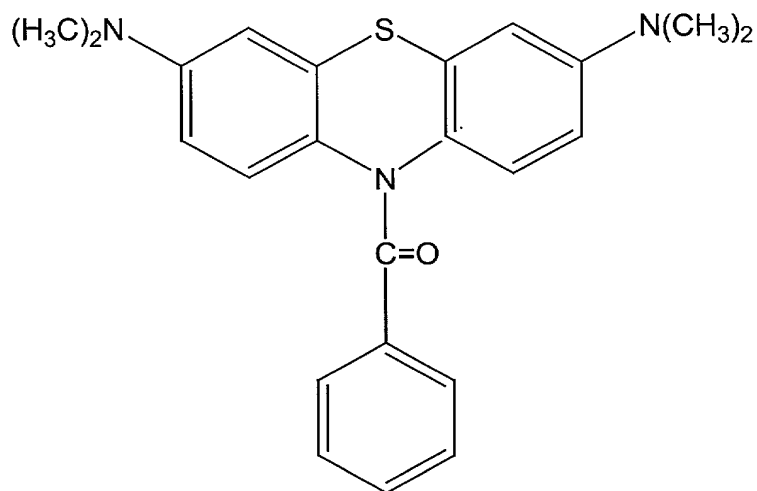


67. The method of claim 54 wherein the infrared sensitive dyes are cyan dyes selected from the group consisting of

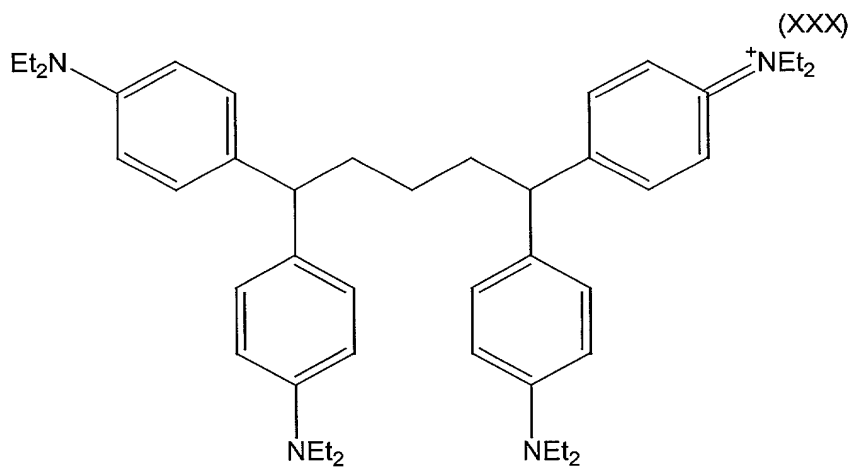
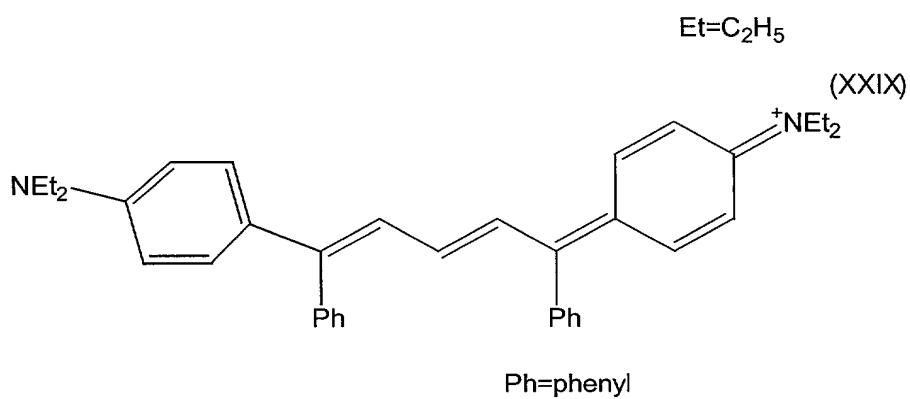
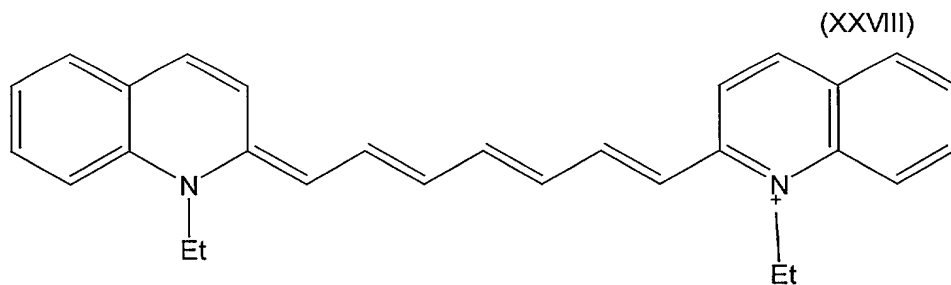
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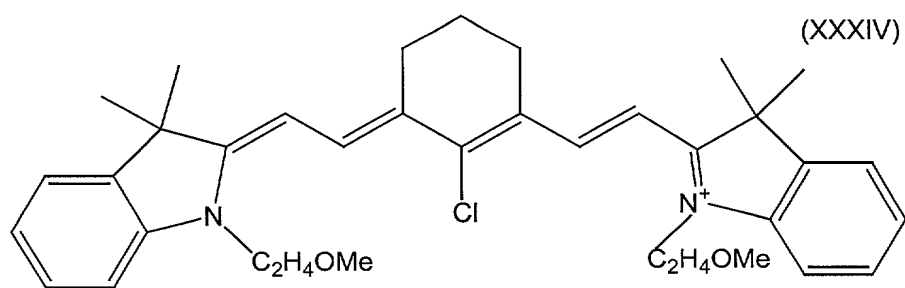
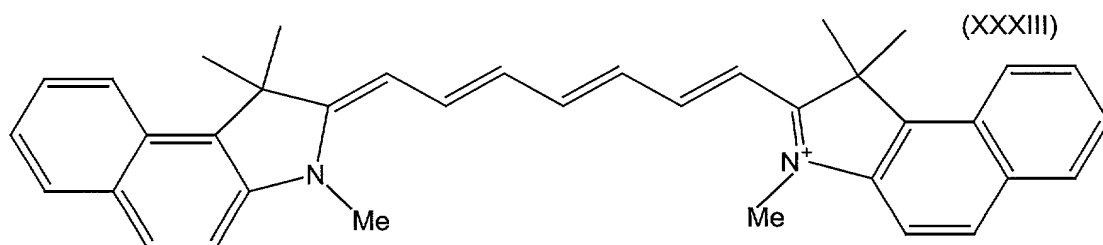
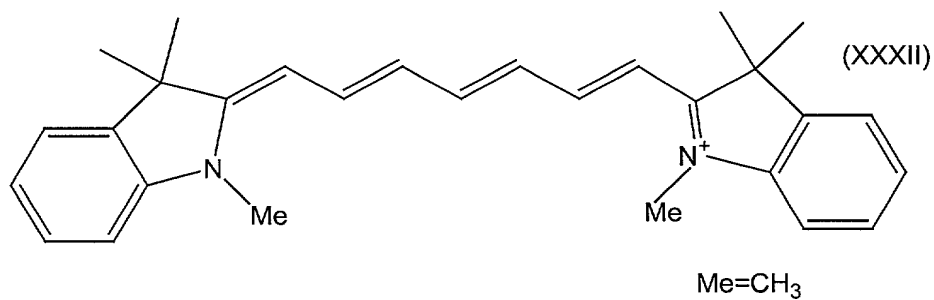
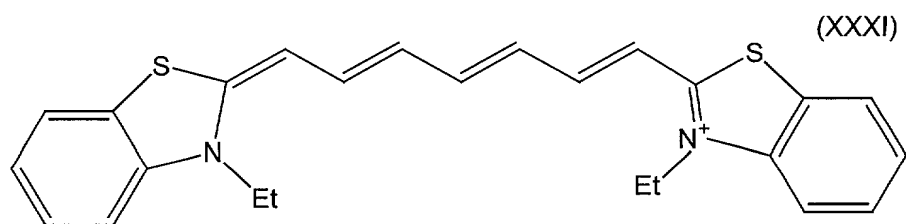


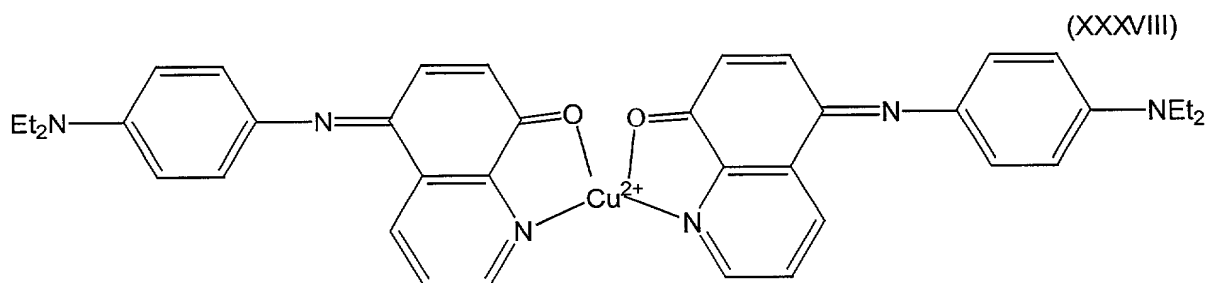
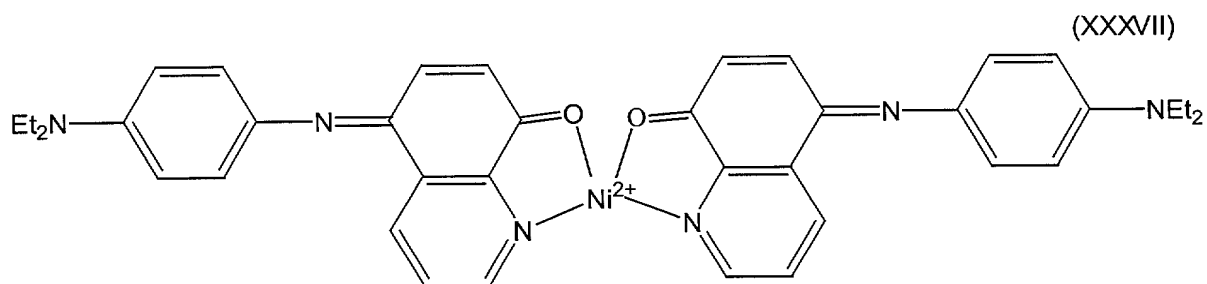
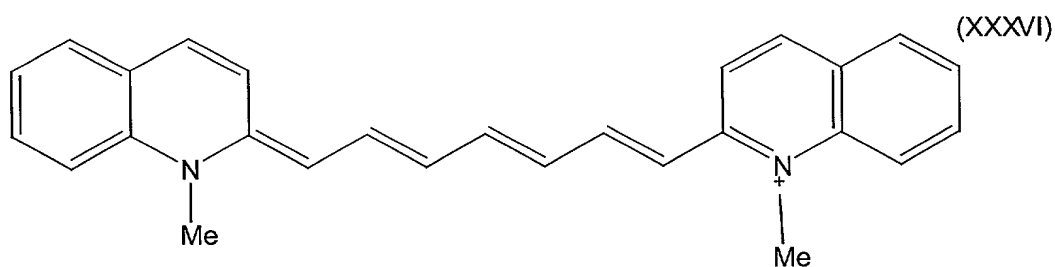
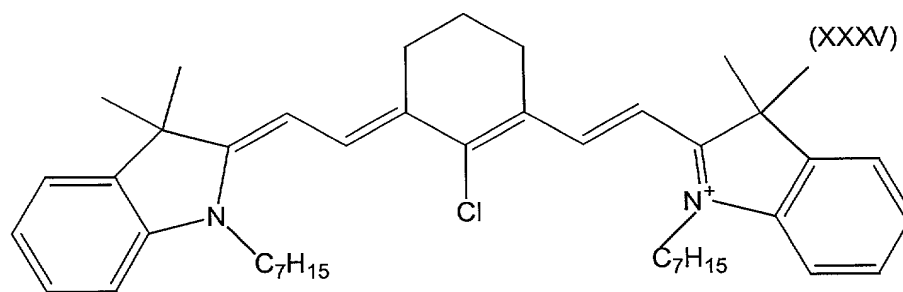
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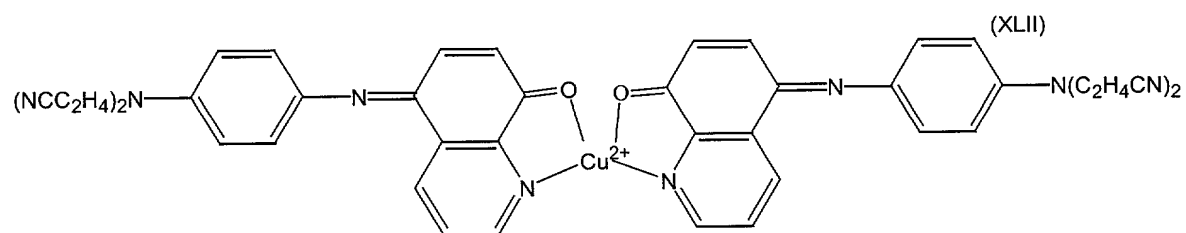
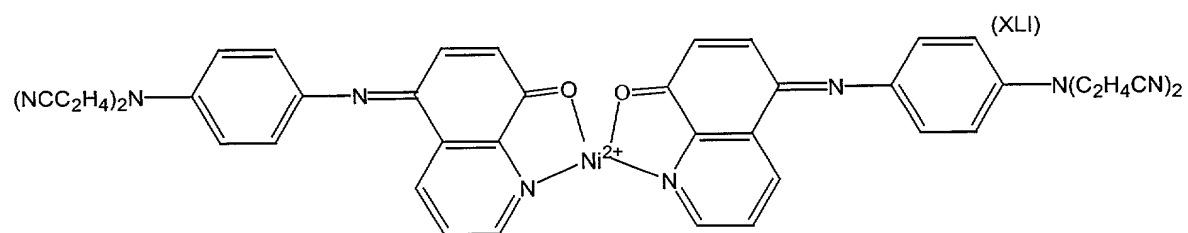
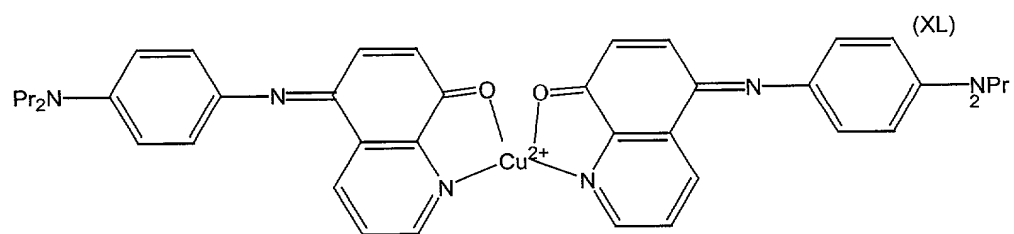
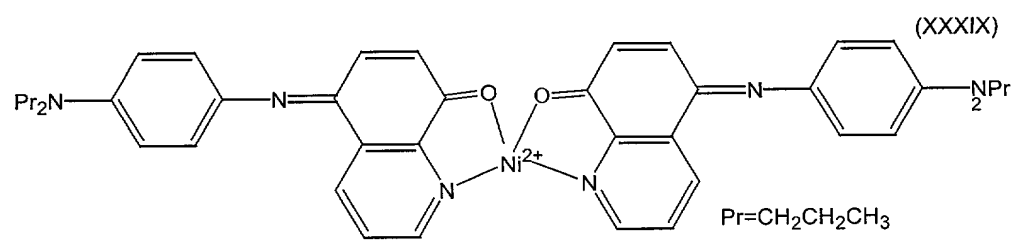


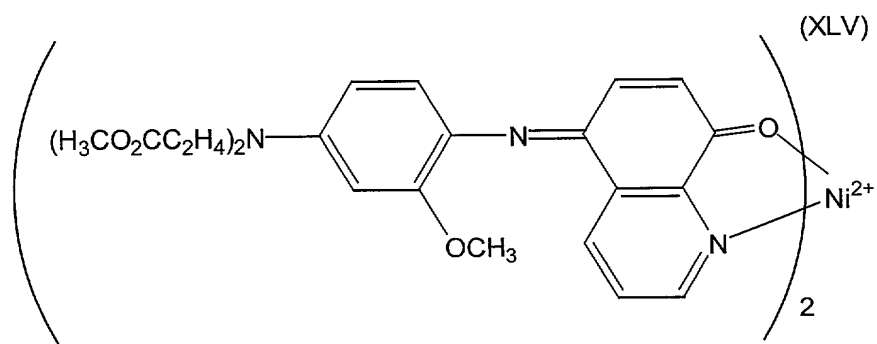
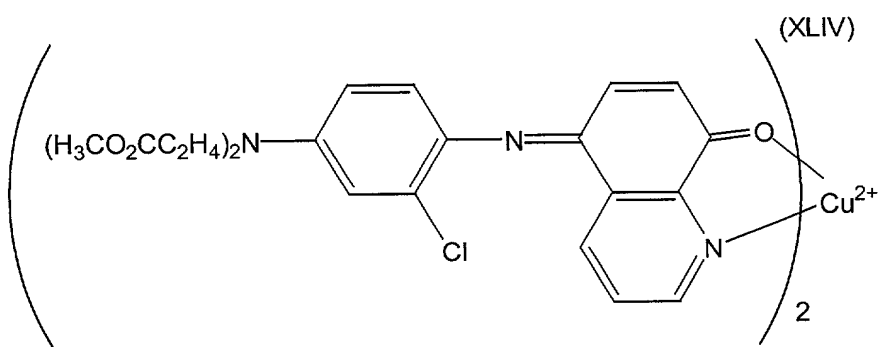
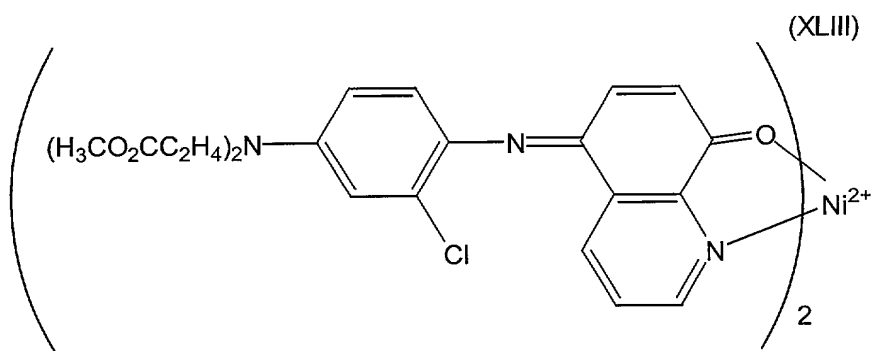
68. The method of claim 54 wherein the infrared sensitive dyes are selected from the group consisting of

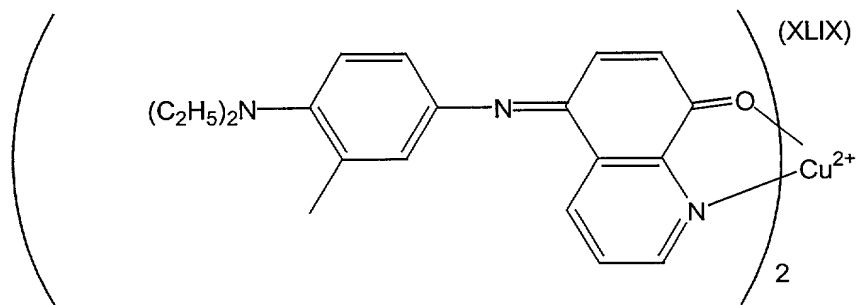
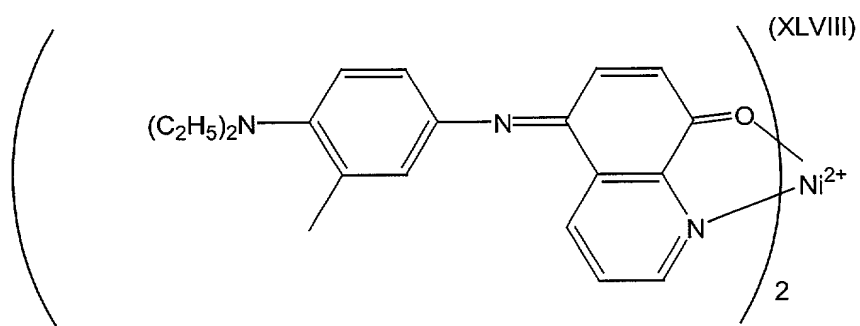
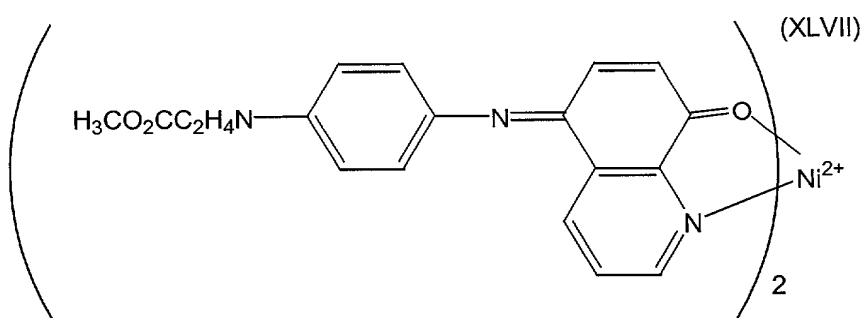
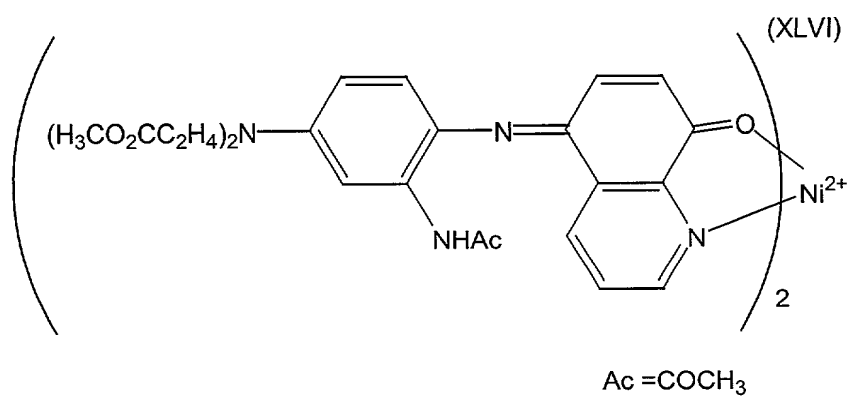


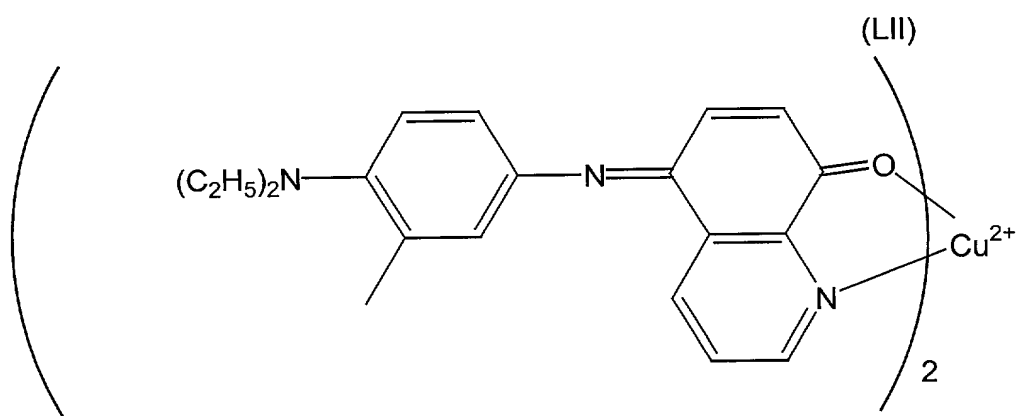
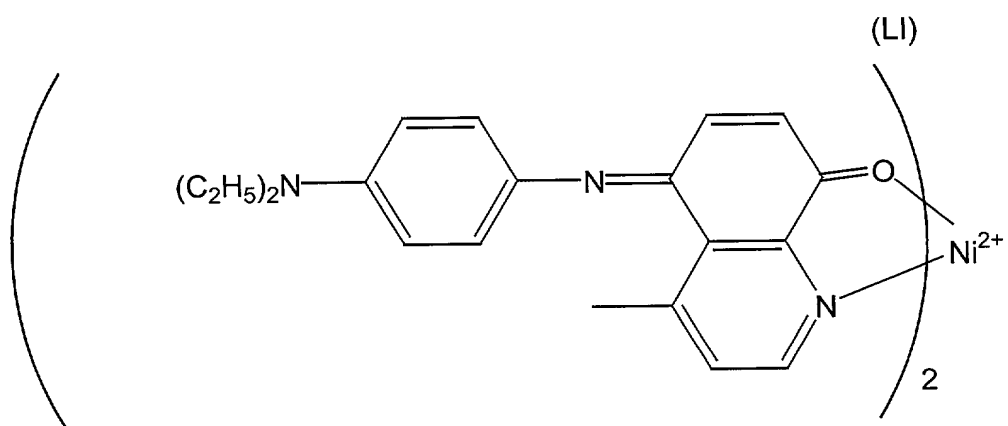
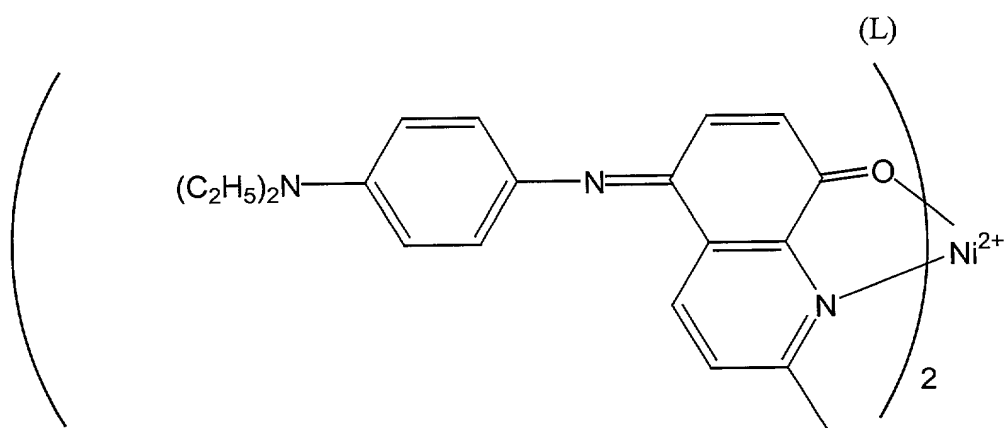












69. The method of claim 54 wherein the heat sensitive dyes comprises Basic Green 4; Solvent Yellow 56; Chemithermal CFBK90; Chemithermal CFBK120; Chemithermal CFBE90; Chemithermal CFBE120; Permanent Temp Tell Yellow Ink; Permanent Temp Tell Red Ink; Permanent Temp Tell Blue Ink; Permanent Temp Tell Green Ink; Permanent Temp Tell Orange Ink; Permanent Temp Tell Purple Ink; and Permanent Temp Tell Black Ink.

70. The method of claim 54 wherein the heat sensitive dyes are leuco dyes selected from the group consisting of:

10 aminotriarylmethanes; aminoxanthenes; aminothioxanthenes; amino-9,10-dihydroacridines; aminophenoxazines; aminophenothiazines; aminodihydrophenazines; aminodiphenylmethanes; leuco indamines; aminohydrocinnamic acids (cyanoethanes, leuco methines) and corresponding esters; hydrozines; leuco indigoid dyes; amino-2,3-dihydroanthraquinones; tetrahalo-p,p'-

15 biphenols; 2(p-hydroxyphenyl)-4,5-diphenylimidazoles; phenethylanilines; indanones and combinations thereof.

71. The method of claim 70 wherein the leuco dyes are selected from the group consisting of aminotriarylmethanes, aminoxanthenes, and leucoindigoid dyes.

72. The method according to claim 71, the leuco dyes being aminotriarylmethanes wherein two of the aryl groups are phenyl groups having an R1R2N-substituent in the position para to the bond to the methane carbon atom and wherein each of R1 and R2 are independently selected from hydrogen, C1-C10 alkyl, 2-hydroxyethyl, 2-cyanoethyl, and benzyl and wherein the third aryl group is selected from:

- a) phenyl which can be substituted with lower alkyl, lower alkoxy, chloro, diphenylamino, cyano, nitro, hydroxy, fluoro or bromo;
- b) naphthyl which can be substituted with amino, di-lower alkylamino, alkylamino;

- c) pyridyl which can be substituted with alkyl;
- d) quinolyl;
- e) indolinylidene which can be substituted with alkyl.

5 73. The method according to claim 72, wherein R1 and R2 are selected from hydrogen and alkyl of 1-4 carbon atoms.

74. The method according to claim 71 wherein the aminotriarylmethanes are selected from tris(N,N-dimethylaminophenyl)methane (LCV); deuterio-tris(N,N-
 10 dimethylaminophenyl)methane (D-LCV); tris(N,N-diethylaminophenyl)methane (LECV); deuterio-tris(4-diethylaminophenyl)methane (D-LECV); tris(N,N-di-n-propylaminophenyl)methane (LPCV); tris(N,N-din-butylaminophenyl)methane (LBCV); bis(4-diethylaminophenyl)-(4-diethylamino-2-methylphenyl)methane (LV-1); bis(4-diethylamino-2-methylphenyl)-(4-
 15 diethylamino-phenyl)methane (LV-2); tris(4-diethylamino-2-methylphenyl)methane (LV-3); deuterio-bis(4-diethylaminophenyl)-(4-diethylamino-2-methylphenyl)methane (D-LV-1); deuterio-bis(4-diethylamino-2-methylphenyl)(4-diethylaminophenyl)methane (D-LV-2); bis(4-diethylamino-2-methylphenyl)(3,4-dimethoxyphenyl)methane (LB-8);

20

75. The method of claim 72 wherein the aminotriarylmethane leuco dyes have alkyl substituents selected from C1-C4 alkyl, the substituents bonded to the amino moieties.

25 76. The method of claim 75 wherein the aminotriaryl methane leuco dyes are further substituted with one or more alkyl groups on the aryl rings, the alkyl groups being independently selected from C1-C3 alkyl.

77. The method of claim 74 wherein the amino triarylmethane leuco dyes are
 30 selected from the group consisting of: D-LECV, LV-1, LV-2, D-LV-1, and D-LV-2.

78. The method of claim 77 wherein at least one of the aminotriarylmethane leuco dyes is selected from LV-1 and LV-2.

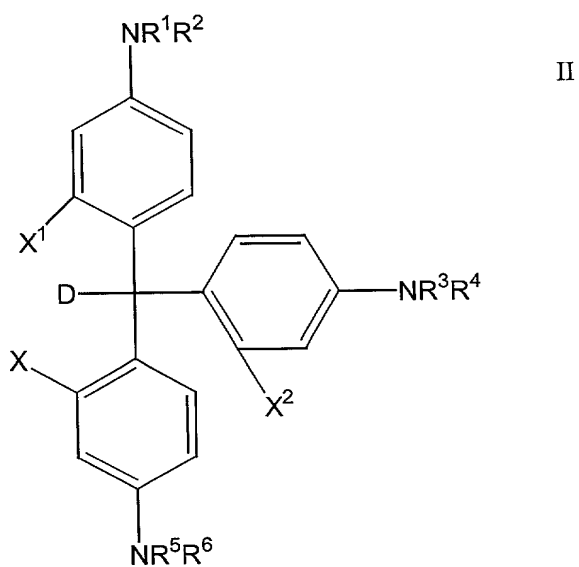
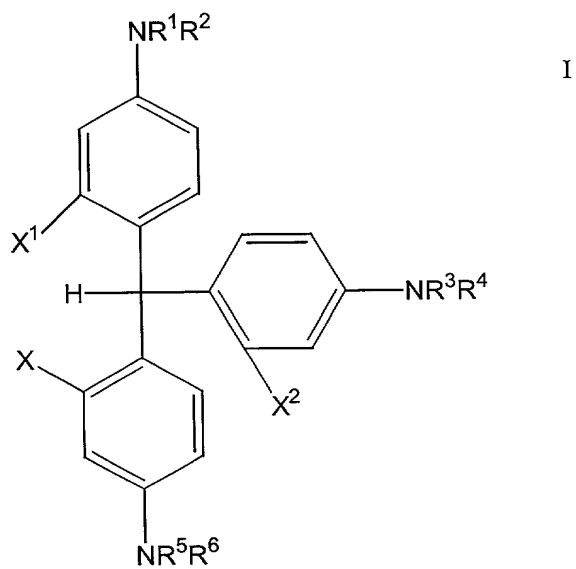
79. The method of claim 77 wherein at least one of the aminotriarylmethane leuco
5 dyes is Trans-3-hydroxy-2-(p-diethylaminobenzyl)indanone (LY-1).

80. The method of claim 77 wherein at least one of the aminotriarylmethane leuco dyes is Benzo((a)-6-N,N-diethylamino-9-(2-methoxycarbonyl)-phenylxanthene (LM-
5) .

10

81. The method of claim 77 wherein the aminotriarylmethane leuco dyes comprise at least one of chemical structures I and II:

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wherein I and II have components X, X₁, X₂ and R₁ through R₆ selected from a) through g):

- a) X, X¹ and X² are H; R¹ through R⁶ are H.
- 5 b) X, X¹ and X² are H; R¹ through R⁶ are CH₃.
- c) X, X¹ and X² are H; R¹ through R⁶ are C₂H₅.
- d) X, X¹ and X² are H; R¹ through R⁶ are independently selected from H and C3-8 alkyl.

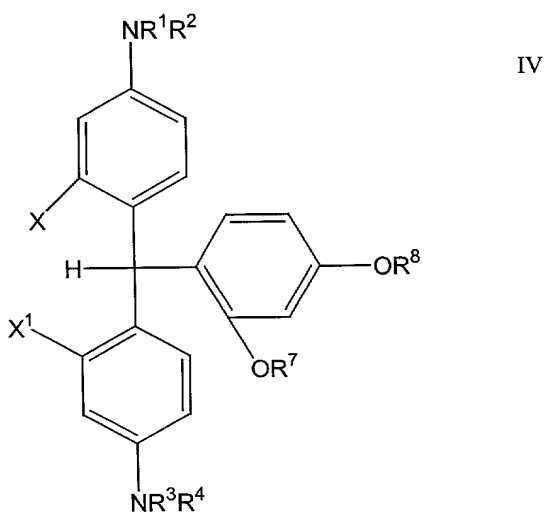
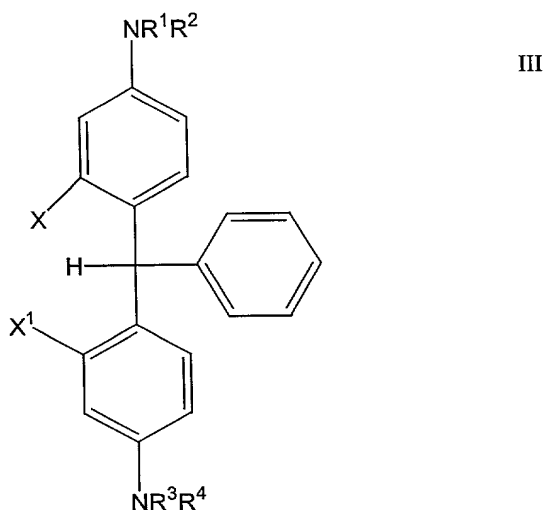
e) X and X¹ are H; X² is CH₃; R¹ through R⁶ are independently selected from H and C1-C8 alkyl.

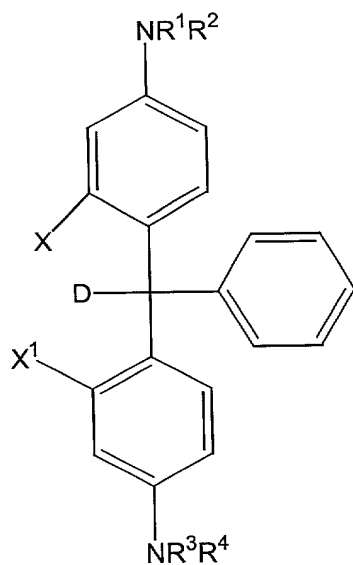
f) X is H; X¹ and X² are CH₃; R¹ through R⁶ are independently selected from H and C1-C8 alkyl.

5 g) X, X¹ and X² are H; R¹, R³ and R⁵ are independently selected from aryl C6-C10; substituted C6-C10 aryl; and R², R⁴, and R⁶ are H.

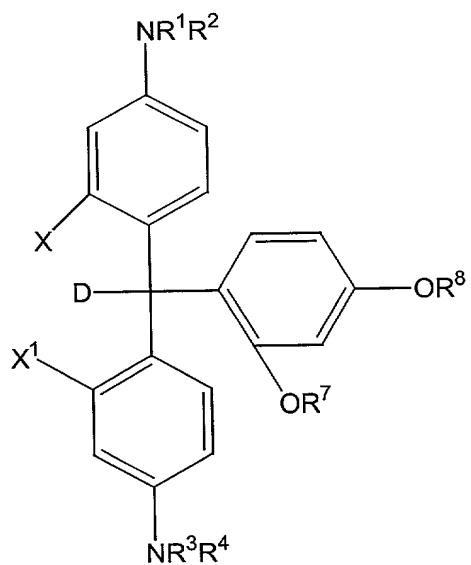
82. The method of claim 76 wherein the aminotriarylmethane leuco dyes comprise at least one of chemical structures III through VI:

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V



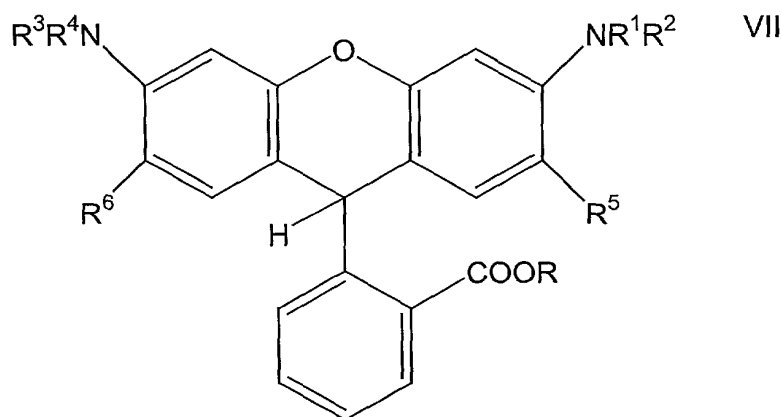
VI

- 5 wherein III through VI have components X, X¹, X² and R¹ through R⁶ selected from a) through c):

a) X and X¹ are H; and R¹ through R⁴ are independently selected from H and C1-C8 alkyl

- b) X and X¹ are H and R¹ and R³ are aryl; and R² and R⁴ are H
- c) X = CH₃, X¹ = H and R¹ through R⁴ are independently selected from H and C1-C8 alkyl; and R⁷ and R⁸ are independently selected from C1-C8 alkyl, or R⁷ and R⁸ are bridged to form a cyclic attachment with a CH₂- or C₂H₄- bond, thereby forming a five- or six-membered ring, respectively.

83. The method of claim 74 wherein the aminotriarylmethaneleuco dyes comprise chemical structure VII:



- 10 wherein R is independently selected from H, C1-C8 alkyl; R⁵ and R⁶ are independently selected from H and C1-C4 alkyl; R¹ through R⁴ are independently selected from H and C1-C6 alkyl, C6-C10 aryl with the proviso that, if R¹ and R³ are aryl, then R² and R⁴ are hydrogen.

- 15 84. The method of claim 70 wherein the leuco dyes comprise at least one of aminotriarylmethanes and aminoxanthenes.

85. The method of claim 84 wherein the heat sensitive dyes are near IR-absorbing dyes comprising at least one of
- 20 1) DF-1: 2-((2-((2-chloro-3-(((1,3-dihydro-1,3,3-trimethyl-2H-indol-2-ylidene)ethylidene)-1-cyclopenten-1-yl)ethenyl)-1,3,3-trimethyl-3H-indolium trifluoromethanesulfonate;

- 2) RD-1: Cyasorb® IR-165 Near IR Dye(absorption maximum at 1070 nm); and
 3) SQS 4((((3-((((2,6-bis(1,10-dimethylethyl)-4H-thiopyran-4-ylidene)methyl)-2-methyl)-2-hydroxy-4-oxo-2-cyclobuten-1-ylidene)methyl)-2,6-bis(1,1-dimethylethyl)thiopyrilium hydroxide, inner salt,

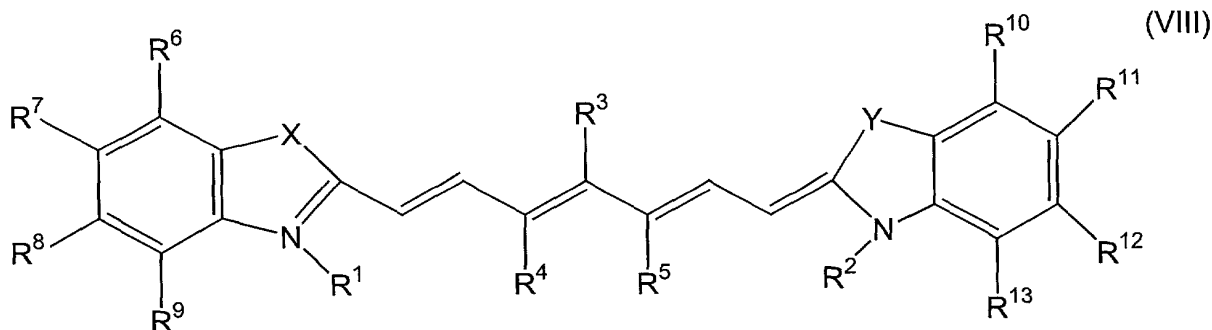
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86. The method of claim 85 wherein the heat sensitive dyes are near IR absorbing dyes comprising at least one of DF-1 and RD-1.

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87. The method of claim 86 wherein the heat sensitive dyes are near IR absorbing dyes comprising DF-1.

88. The method of claim 53 wherein the heat sensitive dyes comprise Heptamethine cyanine dyes having a chemical structure (VIII) as shown below:



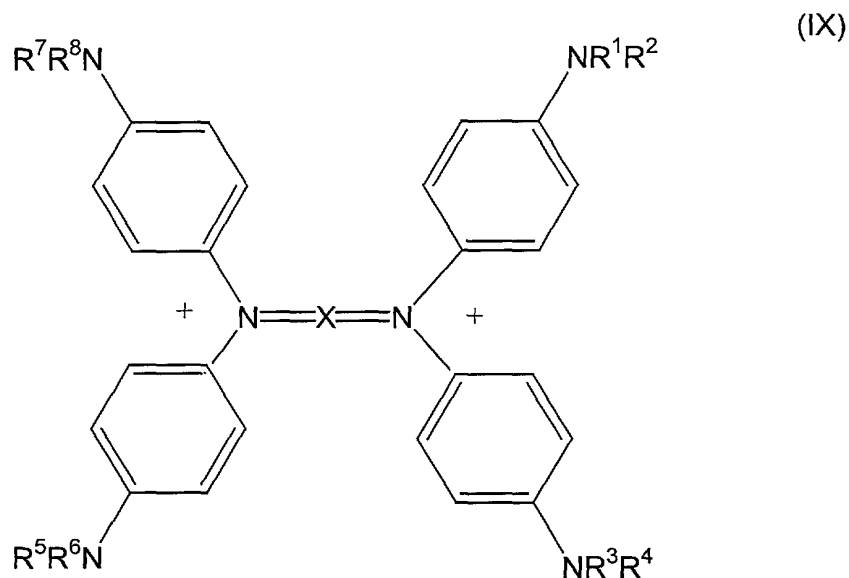
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where R3 can be H, halogen, alkyl, aryl, aryl, alkoxy, aryloxy, thioalkyl, or thioaryl;
 R4 and R5 are independently selected from H, alkyl, aryl, or are bridged to form a
 cyclic attachment; each of R6 through R13 is independently selected from H, alkyl,
 20 aryl, or any two adjacent R6 through R9 and any two adjacent R10 through R13 can
 form R10 through R13 can form a fused aryl; each of R1 and R2 are independently
 selected from alkyl, aryl and substituted alkyl; X and Y, which may or may not be
 identical, are each represented by the formula CR'R' where R', R'' are independently
 selected from alkyl, aryl and substituted alkyl; X and Y, which may or may not be

identical, are each represented by the formula $CR'R''$ where R' , R'' are independently selected from H, C1-C6 alkyl, O, S, Se and Te.

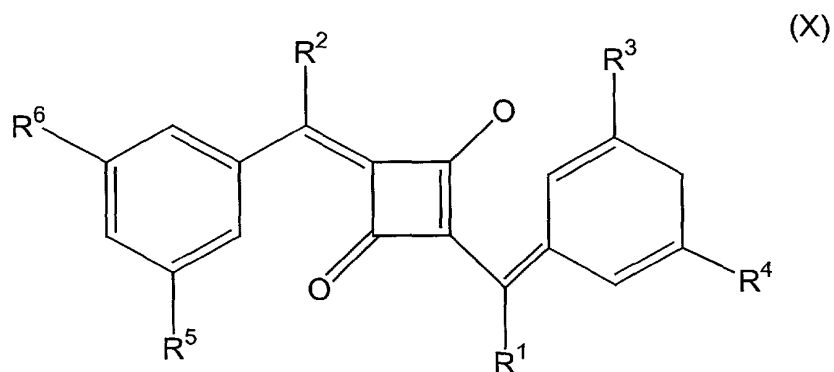
89. The method of claim 53 wherein the heat sensitive dyes comprise

5 Benzenaminium dyes having structure (IX) as shown below:

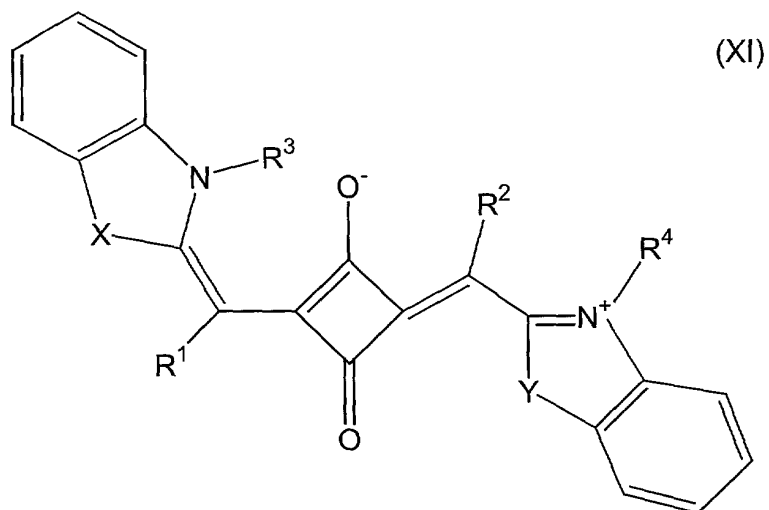


wherein each of R^1 through R^8 is independently selected from C1-C6 alkyl; X is a substituted 1,4-cyclohexadiene.

10 90. The method of claim 53 wherein the heat sensitive dyes are near IR-absorbing dyes having structure (X) or structure (XI) as shown below:

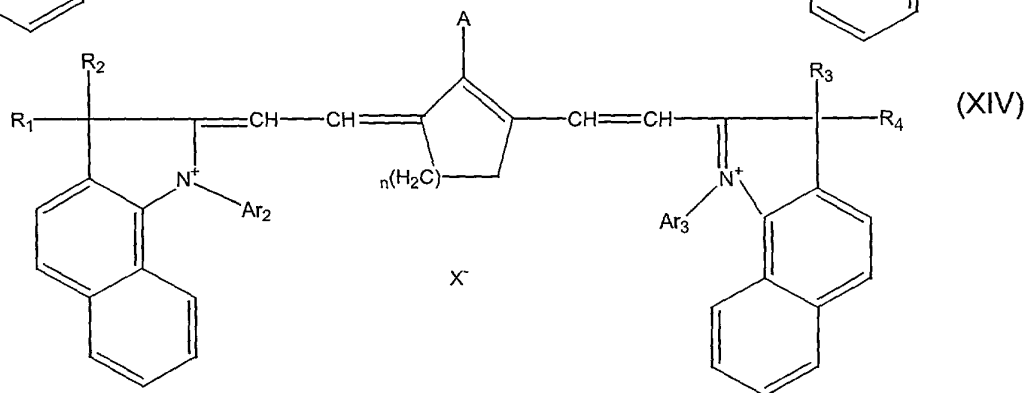
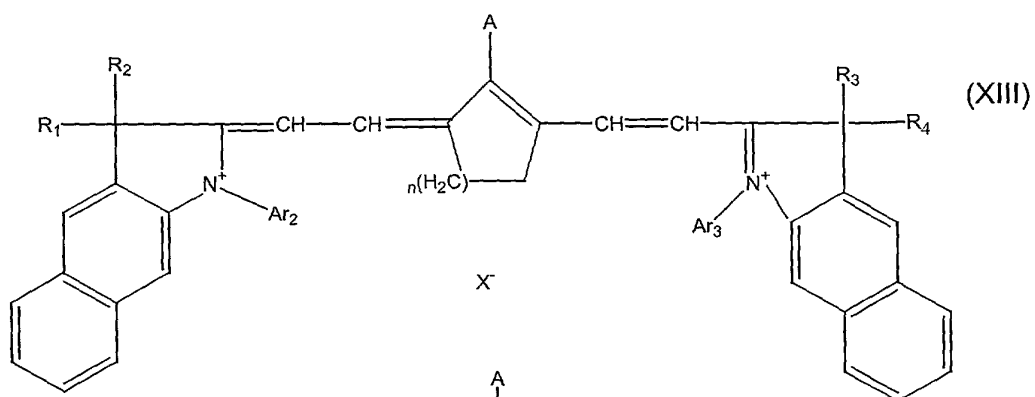
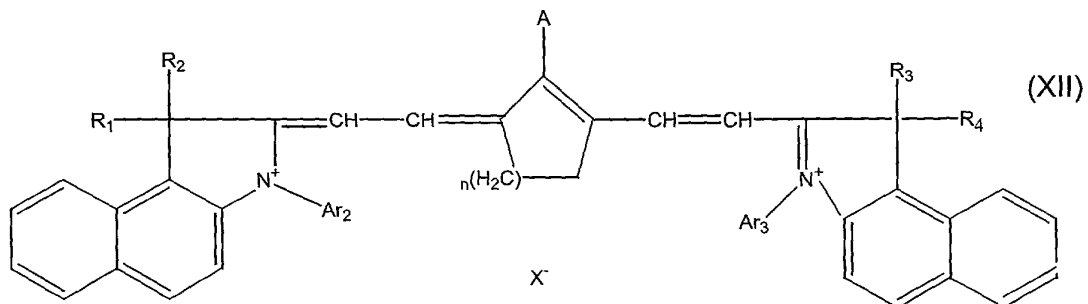


wherein each of R¹ through R⁶ is independently selected from H, C₁-C₆ alkyl; X and Y are independently selected from O, S, Se, Te, N-R⁷, wherein R⁷ is selected from C₁-C₆ alkyl and



- 5 wherein each of R¹ and R² is independently selected from H, C₁-C₆ alkyl; each of X and Y is independently selected from O, S, Se, Te, N—R⁷, wherein R⁷ is selected from C₁-C₆ alkyl; each R³ and R⁴ is independently selected from alkyl, aryl or substituted alkyl and wherein the benzene rings in structure (XI) may be further substituted.

91. The method of claim 63 wherein the heat sensitive dyes are near IR-absorbing dyes selected from the group consisting of:



wherein R1-R4 are independently substituted or unsubstituted C1-C6 alkyl; A is substituted or unsubstituted phenyl, naphthyl, C1-C6 alkyl, or C7-C10 aralkyl; Ar2 and Ar3 are independently substituted or unsubstituted phenyl or naphthyl; X is a monovalent anion; and n is 1 or 2.

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92. The method of claim 91 wherein the alkyl, aryl or aralkyl substitution groups comprise at least one of: hydroxy, alkoxy, chloro, bromo, cyano, and amino.

93. The method of claim 53 wherein the heat-sensitive dyes are near IR-absorbing dyes selected from the group consisting of: 2-(((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((e)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclohexen-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((e)indolium p-toluenesulfonate (JC-1); 2-(((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((e)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclopenten-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((e)indolium p-toluenesulfonate (JC-2); 2-(((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((f)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclohexen-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((f)indolium p-toluenesulfonate (JC-3); 2-(((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((f)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclopenten-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((f)indolium p-toluenesulfonate (JC-4); 2-(((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((g)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclohexen-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((g)indolium p-toluenesulfonate (JC-5); 2-(((3-(((1,1-dimethyl-1,3-dihydro-3-phenyl-2H-benz((g)indol-2-ylidene)ethylidene)-2-phenyl-1-cyclopenten-1-yl)ethenyl)-1,1-dimethyl-3-phenyl-1H-benz((g)indolium p-toluenesulfonate (JC-6).

94. The method of claim 93 wherein the near IR-absorbing dyes comprise at least one of JC-1 and JC-2.

95. The method of claim 93 wherein the near IR-absorbing dyes comprise JC-1.

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96. The method of claim 54 wherein the dyes are encapsulated in microcapsules, the microencapsulated dyes comprising polymers having T_g from 80°C to 200°C.

97. The method of claim 96 wherein the polymers are selected from the group
5 consisting of polyurethanes, acrylates, styrenes and combinations thereof.

98. The method of claim 96 wherein the polymers comprise styrene-butylacrylate-polyethylene glycol acrylate.

10 99. A recording medium recorded with image data according to the method of claim 50.

100. A recording medium recordable with image data according to the method of claim 50.

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